The Roofing, Cornice and Skylight Manual.

PRACTICAL ARTICLES ON LAYING FLAT AND STANDING SEAM ROOFING, CORNICE SHOP PRACTICE AND SKYLIGHT CONSTRUCTION.

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PREFACE.

In this book are presented three articles on as many subjects—viz., Tin Roofing, Cornice Work and Skylight Construction. The book is prepared to comprehend all three branches of work, both on account of their close relationship and of the dearth of reliable literature on the respective subjects.

The article on roofing, which was prepared specially for this book by an expert mechanic, gives plain directions for laying flat and standing seam roofing. A table is appended which will prove useful to many in estimating the quantity of tin required for roofs.

The Country Cornice Shop, comprising the second and most extended article, is compiled from the columns of *The Metal Worker,* having been published serially in that journal.

In the concluding pages are presented the first and second prize essays of a competitive series of articles on skylight work which were also originally published in *The Metal Worker.* These essays, with the accompanying diagrams, constitute an exceedingly valuable exposition of skylight construction.

It is believed that the book as a whole will prove useful as a guide and work of reference to tinsmiths and cornice makers.

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TIN ROOFING.

Equipment and Methods.

An important branch of the sheet metal trade is tin roofing, and to build up a successful business the roofer must select well coated plates and use care in preparing the tin for the roof and in putting it on. When the tin is bought the shop must be equipped to prepare it for use. If a high grade plate has been selected it may be assumed that every sheet is square and it only needs to be edged in the edger. If it is to be used for standing seam roofing, strips of the various lengths that may be required can be best secured by cutting from a roll made up of edged sheets locked together and soldered.

THE ROOFING BENCH.

The work of putting the tin together to make the roll can best be done on a special bench about 20 feet or more in length, made of 2-inch or thicker yellow pine or other hard wood planed smooth on the top side. The bench should be 30 inches wide, with a pitch of 1 inch down to the front, so that solder will flow readily. It should be well supported, and some benches are made with iron plates 3 inches wide and ½ inch thick where the locked edges come to stand the wear of the mallet. The back edge must be perfectly straight from end to end, with a hard wood gauge about 3 inches high extending the whole length. This edge may be faced with metal to prevent wear and preserve its trueness as a straight edge.

PUTTING THE TIN TOGETHER.

After the sheets have been edged, with one edge turned up and the other down, a number may be spread along the bench to have their edges locked together to form a continuous strip. This is best done by locking one pair of edges at a time. The first sheet must be held firmly against the straight edge by a gauge fastened to the bench or by a double hook, one end of which catches the sheet and the other catching over the back of the bench. The

other sheets may then be locked on one at a time and have the seam flattened down tight with a mallet, great care being taken to see that the side of each sheet is perfectly in line against the straight edge guard at the back of the bench. A box of tin contains 112 sheets, and in some shops they are put together in four rolls of 28 sheets each and the rolls when soldered weigh about 60 pounds. The seams may be soldered as soon as the locked edges of one strip are flattened down with the mallet and before rolling up, or the roll may be completed and several boxes of tin may be put together and the soldering done at another time.

SOLDERING.

In soldering an old hand will want coppers weighing eight pounds to the pair, powdered rosin, good solder and a fire pot large enough to heat the coppers quickly. Experienced men are very careful to leave a space ¼ inch unsoldered or very lightly soldered at each end of the seam. This will make it easier to turn the edges and make the locks on the roof. The strips are generally 20 inches wide and 20 x 28 inch tin is used, owing to there being fewer seams to be soldered than if 14 x 20 inch tin is used. If 10-inch strips are needed for valleys or flashings it is only necessary to slit the 20-inch tin down the middle. If 14-inch strips are wanted labor is saved by putting the tin together in 28-inch rolls and slitting it down the middle.

PAINTING THE UNDER SIDE.

After the soldering is done the tin is ready to be painted on the under side, if the contract demands it, but in painting a space ½ to ¾ inch wide should be left along each edge, so that no oil or burned paint will interfere with soldering on the roof.

The rolls when finished are about a foot in diameter, and the end is fastened to the roll by tacking with solder lightly so that it can be easily opened with the roofing hammer, or the rolls may be fastened with wire or tin strips. A box of 20 x 28 tin can be edged on a folder by a lively boy in about 25 minutes, and smaller tin a little quicker. A box can be put together and the seams flattened down with a broad faced mallet in half an hour or a little more, and the soldering can be done in a little less time.

THE USE OF PAPER.

In order to deaden noise from the tin and to prevent moisture reaching the under side of the tin, paper or felt is laid on the roof before the tin is put on. A good, thick building or sheathing paper is selected ordinarily, but often an oil or rosin sized paper is used where it is desired to keep moisture away from the tin. If there is no wind and the roof is small, so that it may be completed in one day, the roof is covered with paper before the tin is laid, or only so much of the roof is covered with paper as can be finished in one day. The paper is fastened here and there as necessary with small nails with the heads driven well down. In windy weather the paper is only laid as the tin is put on.

FLAT SEAM ROOFING IN STRIPS.

If the roof to be covered is very flat, so that it must be soldered to be water tight, or if it is small in size, the tin is put on with a flat seam by two methods, in strips or sheet at a time. If put on in strips half-inch tongs are used to turn half-inch edges on the strips. The tongs have jaws about 20 inches long, with holes in one jaw and curved pins about 2 inches long in the other jaw which work through the holes, and they are set so that the edge turned on the tin is just ½ inch wide. In laying the tin the first strip is laid at and parallel with the eave and extends over so that it can be turned down and fastened with 1-inch barbed roofing nails about 2 or 3 inches apart. The ½-inch edge is turned on the other edge of the strip, which is fastened to the roof with barbed roofing nails about 4 inches apart, for the closer the nails the easier and quicker it is soldered and the less solder required.

The nails must be driven back in under the edge, so that when the edge of another sheet is hooked in and flattened down tight with a mallet the nail heads will be covered. If tinned nails are used the soldering will be more secure. This method leaves less soldering to be done on the roof, consequently the outdoor work can be completed quicker and with less exposure to the workmen in summer or winter. By this method there are no nails in the cross seams, and in consequence some roofers use strips only 14 inches wide, while others use 20-inch strips for all such work.

The soldering should be done with heavy coppers with blunt ends, so they will hold the heat, and the seams should be well soaked with a hot copper so that the solder will sweat into the locks and make the seams surely tight, for any time spent in hunting for and mending leaks is a dead loss, even if no damage is done to the building.

Flat Seam Roofing.

Another style of flat seam tin roofing consists of single sheets of edged tin laid separately, each sheet interlocking, and fastened to the roof boards by means of nails or cleats. The locks are flattened with a heavy mallet and then soldered with heavy roofing coppers.

NOTCHING AND EDGING.

On receipt of the tin in the shop, one of the first steps in preparing it for flat seam roofing is to notch or cut off the four corners of each plate, after which they are ready to be edged. A box of tin plate containing 112 sheets can usually be notched in 15 minutes. To ascertain what portion of the corners should be cut off proceed as illustrated in Fig. 1. A B C D represents a sheet of

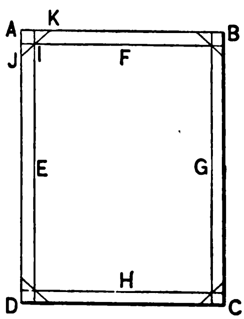


Fig. 1.—Notching the Sheet.

tin. Assuming that ⅜-inch edges are required, set the dividers ⅜ inch and scribe the lines E F G and H; where the lines intersect, as at I, draw the line J K at an angle of 45 degrees, and so on all corners. J K will represent the amount of tin which would be notched from each corner of the sheet. If a notching machine is used the gauges are set, so that the required amount is notched, three sheets at a time. Where little roofing is done these corners can be notched with hand or stock shears.

After the tin is notched it is edged with a flat seam roofing edger, the long and short seam B and C, in Fig. 2, one way, and

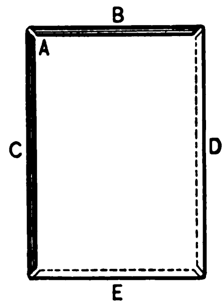


Fig. 2.—Edging the Sheet.

the opposite long and short seams D and E the other way; then the notched corners will appear as at A. After the edging the sheets are stacked in lots of 11 sheets for 14 x 20 tin, and 25 sheets for 10 x 14 tin.

HAND TOOLS, FIRE POTS AND SUPPLIES.

The tin now being ready for use at the building, it will be convenient to provide a box, say 12 x 16 inches in size and about 4 inches high, made with three compartments and with a circular handle over it. One-inch wire nails, 2½-inch wall hooks and rosin are placed in these compartments. The tools required are 8-pound soldering coppers for roofing, as shown in Fig. 3, and 6-

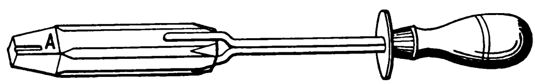


Fig. 3.—Square End Roofing Copper.

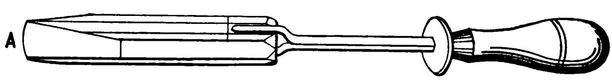


Fig. 4.—Pointing Up Copper.

pound pointing up coppers, as shown in Fig. 4; a file, a hammer, shears, a compass, a punch, a cold chisel, a mallet, a scraper, a

trowel, and chalk and chalk line. A fire pot 15 inches high and 8 inches in diameter is required for the roofing coppers, a smaller pot 12 inches high and 6 inches in diameter is large enough for the pointing coppers and will consume less coal. Solder, coal, acid for galvanized iron connections, a paint brush, and paintskin, an iron block on which to forge coppers, a rope and wheel to hoist material, a broom, and a small tool box with lock and key to lock up tools and material over night, constitute all that would be required for work on the roof.

The heavy soldering coppers are used for flat seam soldering and the lighter ones to do "pointing up," or soldering upright seams. The file is employed to clean and smooth the coppers. The coppers are tinned with rosin when used for soldering tin work, using rosin as a flux. They are tinned with sal ammoniac for soldering zinc or galvanized iron work, when acid is used as a flux. The hammer and shears are used in laying the tin, the compass for scribing circles or for other purposes. The punch is employed to make holes in double thicknesses of metal, the cold chisel to dig out joints for flashings, the mallet to flatten the seams, the scraper to obtain a smooth, clean surface on old metal joining to new work, and the trowel to paintskin the joints of the flashings connecting with the walls.

LAYING A SHED ROOF.

Having these tools and materials and knowing their respective uses, we will assume that our first job is a small shed roof

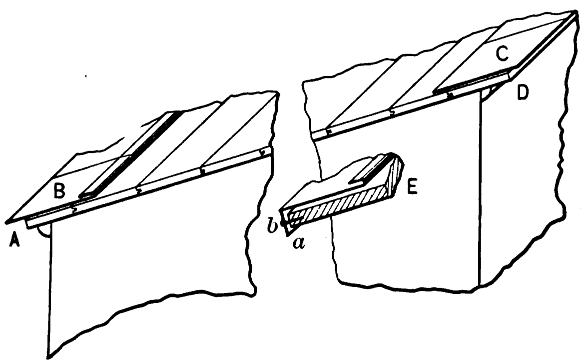


Fig. 5.—Starting and Finishing a Shed Roof.

having no gutter, the water dripping off the edge at A, as in Fig. 5. In starting upon a roof of this kind, which has no gutter, the tin B is laid sheet by sheet, allowing it to project over the eave about 1 inch, as at A. It is finished at the top, as shown by the last course C, which also projects at D; then with a piece of plank measuring about 4 x 8 inches and 1 inch in thickness the edges are dressed down well with a mallet, as shown in diagram E at *a,* after which it is nailed, as shown at *b,* with 1-inch roofing nails. A mistake which is often made is in dressing the edges with a mallet. This causes the edge to lose its straight line and to show a succession of buckles.

Occasionally on a shed roof, or other roof of frame buildings, a ledge is built on the gable or side walls, as in Fig. 6. This is the

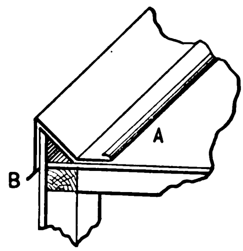


Fig. 6.—Side Strip on a Shed Roof.

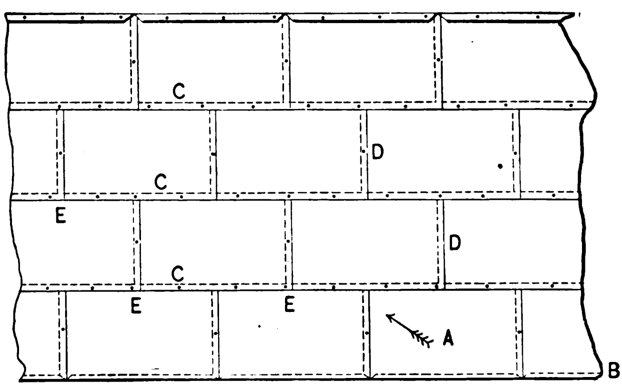


Fig. 7.—Laying and Nailing the Sheet.

proper form to throw off the water well and avoid acute angles. These strips are put on before the roof is started, having a lock at

A, and being turned over the clapboarding or other surface with a drip, as at B.

Assuming that the roof is to be covered with 14 x 20 plate, the sheets are laid as indicated in Fig. 7, the general rule being to lay the sheets in the direction of the arrow A, giving four nails to the sheet; one at the butt, two on the long side and one on the short side, as shown by the dots. This will make a firm roof, and hold the seams well. If less than four nails are used the tin is apt to buckle, causing a drumming sound when it is walked upon.

While time is saved in the laying, double this time is lost in soldering, for the heat of the coppers will raise the seams, causing a succession of buckles which retard soldering and require 10 per cent. more solder. In laying the sheets the hammer is used, as indicated in Fig. 8, A being the sheet locked into the sheet B.

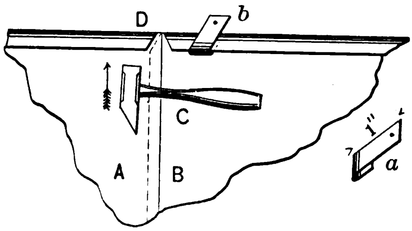


Fig. 8.—*Driving Edge Back to Place Nail.*

The hammer is held in the position C, and is quickly moved forward in the direction indicated by the arrow, both on sheets A and B. The nail C is now driven into the sheet A at the butt, which holds down the sheets A and B firmly. The hammer is now placed as shown in Fig. 9, and held in the position D, the handle inclined

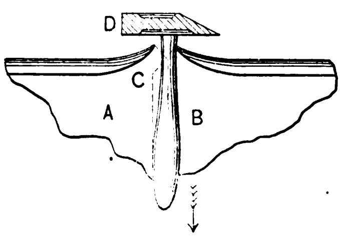


Fig. 9.—*Replacing Edge.*

slightly upward. It is then pressed down and drawn quickly forward, which again brings the edge in the position D, as in Fig. 8. The same directions apply to the nailings in the centers of the sheets.

THE USE OF CLEATS.

Occasionally it is desirable to use cleats instead of nailing through the tin. These cleats are bent as indicated at *a*, Fig. 8. They are made from scrap tin, being cut 1 inch wide and about 1½ inches long; they are then placed in the flat seam edger, folded as shown, and are applied to the sheet as indicated at *b;* this is not the proper place for the cleat where shown, but simply indicates the method of applying. The cleats should be put where nails are shown in Fig. 7. By using the cleats, allowance is made for expansion and contraction of the metal.

Care must be taken after the roof is laid to flatten the seams well with a mallet of sufficient weight for the purpose, and that the heads are filed to a smooth, even and slightly convex surface,

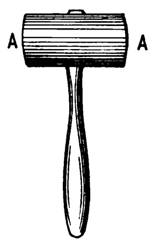


Fig. 10.—*Smooth Round Faced Mallet.*

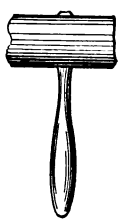


Fig. 11.—*A Bad Mallet for Roofing.*

as shown at A A in Fig. 10. A rough, uneven mallet, as shown in Fig. 11, should not be employed for this purpose.

ROSINING SEAMS, SOLDERING AND COPPERS.

When the seams are perfectly smooth throughout, rosin is ground to powder, and after the roof has been swept clean the powdered rosin is swept against the seams with a clean broom. This powdered rosin is generally used on a mild day. When it is windy the rosin can be burnt on the seams. This is done by heating the coppers not more than is necessary to melt the rosin, and then guiding the corner of the copper over the long and short seams, it is melted on the seam and remains there.

The next and most important step is the soldering. Soldering coppers are employed as shown in Fig. 3, weighing at least eight pounds to the pair; they are heated and tinned as has been explained. It will be noticed that the end is forged square, and has a groove filed in one side, as shown at A. When the copper is turned upward the groove should be filed toward the lower side within ¼ inch from the corner, so that when the groove is placed upon the seam, as shown in Fig. 12, it acts as a guide to the cop-

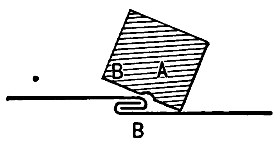


Fig. 12.—Soldering Copper with Groove for Guide.

per, as the latter is drawn along the seam. In this way the largest heated surface rests directly on the seam, "soaking" it thoroughly with solder; as the heat draws the solder between the locks, it is well to use between five and six pounds of solder to 100 square feet of surface. When soldering a long surface, all the long seams, indicated by C, C, and C in Fig. 7, are first soldered, then the short seams, indicated by D and D. After this the "butts" E E E are gone over to prevent any leak.

A good mechanic ought to lay two square of flat seam roofing 14 x 20 plate in a day of eight hours, including soldering flat and upright seams complete.

The rosin should now be scraped off the seams by means of a wire brush. This is usually done by the apprentice and takes little

time. Then the roof should be painted. It may not be out of place to mention that some roofers omit the scraping of rosin, and paint directly over it. This is the cause of the rusting of seams which sometimes occurs. If the paint is applied to the rosin the latter with time will crack and the rain will soak through to the tin surface; when the surface of the roof is dry, by raising the cracked rosin, moisture will often be found underneath. This moisture naturally tends to rust the plate more and more with each storm. If the rosin is removed the entire tin surface will be properly protected by the paint.

VALLEYS AND GUTTERS.

Another sheet, edged on the flat seam edger, is illustrated by Fig. 13, and is known as a valley sheet, having the edges A and B

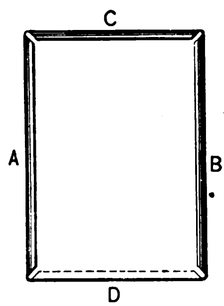


Fig. 13.—*A Valley Sheet.*

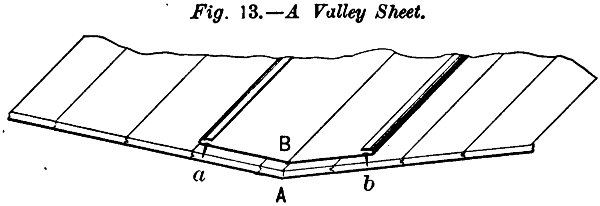


Fig. 14.—*Laying a Valley.*

turned one way, while the short sides C and D are edged right and left. In some cases where required the short sides C and D are edged one way and the opposite sides A and B right and left. The use of valley sheets is shown in Fig. 14. A roof on which the water pitches toward the center is shown by A, and the tin is

laid from both sides, B illustrating the valley sheet in position, nailed at *a* and *b*. Fig. 15 shows how a hanging gutter is pre-

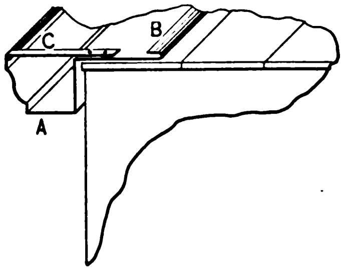


Fig. 15.—*Hanging Gutter.*

pared for on a flat roof. A is the gutter, having a lock bent at B, on which to lock the tinning, while C indicates the brace supporting the gutter and screwed to the roof surface. Care should be taken to solder the screw heads and around the braces or cap to avoid any leakage.

In Fig. 16 is shown how a box gutter made of wood is lined

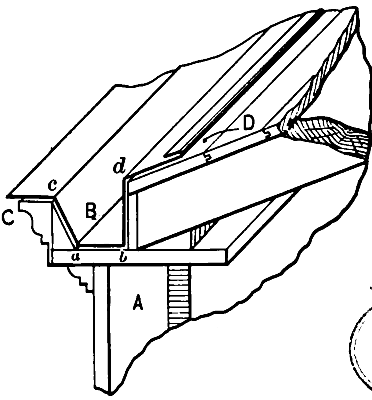


Fig. 16.—*Lining a Box Gutter.*

with tin. The method which will be described for bending up the tin strips will also apply to the bending of wall and curb flashings, etc. Therefore, let A represent the wooden gutter and B the tin

lining in place, projecting over the wood molding at C and having a lock on the roof surface as at D. When the gutter is in place the tin is turned over at C and nailed, in the same manner as shown by *a b* in E, Fig. 5. Assuming that the gutter is 20 feet long in Fig. 16, "knock out" 10 feet of tin strips of the required width, being careful to have a straight line; this is most readily accomplished by taking the first sheet with nails, then following the chalk line or such other line as may be employed, and lock by means of a mallet the required number of sheets.

The short seams are soldered, then the bending is done as shown by the three operations in Figs. 17, 18 and 19. In Fig. 17

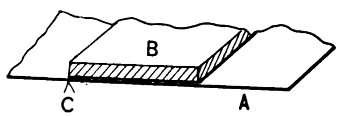


Fig. 17.- *First Operation Bending Strips.*

A represents the tin strip and B an ordinary roof plank having a straight edge; C indicates the first bend which is to be made. Now take the board, lay it at the required point C, on either end, and while standing upon it with the legs slightly spread, stoop down with arms stretched, grasp the tin firmly and bend it slightly upward. Then it will appear as shown in Fig. 18. Now grasp

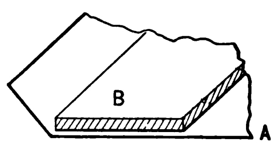


Fig. 18.—*Second Operation Bending Strips.*

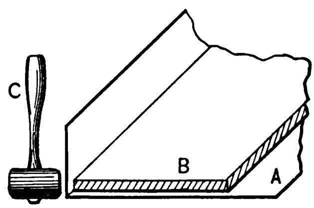


Fig. 19.—*Last Operation of Bending the Strip.*

the tin again and in the same manner, and bring it over to a right angle, after which use the mallet, as shown in Fig. 19, and dress it well against the board. This will complete the last operation in bending the strip. The same work can be done with 10-inch tongs for gutters or flashings, the line of the bend being previously marked out with a chalk line. It should be understood that these operations are essential only for the two bends, *a* and *b*, of Fig. 16. The other two, *c* and *d*, are bent over into the gutter.

CONNECTING ROOF TO WALL FLASHING.

Fig. 20 shows an extension roof which butts against the main building, whose walls are frame. Assuming that the last course of

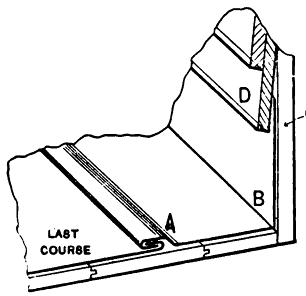


Fig. 20.—Flashing under Clapboarding.

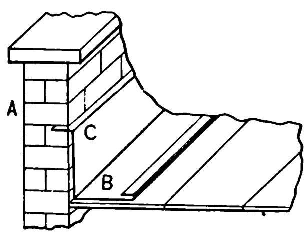


Fig. 21.—Side Strip Inserted to Connect Roof with Wall.

tin is in the position shown, take the distance from the lock A to the wall B, bend off the strip as has been explained, being careful that the tin goes high enough to lap at least 4 inches under the clapboard D. If the clapboard is fast it should be loosened to allow the tin to go under, and not nailed, as is frequently done, on to

the board D and then paintskinned. This will eventually cause a leak. If this main wall were of brick or stone the tin would be let into the joints, as indicated in Fig. 21. This engraving represents a side strip on a flat roof with lock attached, to lay on the roofing. A shows the brick wall and B the tin strip, having a 1-inch edge turned into the joint, then wall hooked and paintskinned. It is usual to turn up side strips to the fourth course of brick over the finished roof. Then these joints are dug out with a cold chisel and hammer, or an old saw can be used having a round handle riveted to it, working it backward and forward into the mortar joints until the required depth is obtained.

Fig. 22 shows a cap and base flashing, which allows for expansion and contraction of the metal. When the wall has been carried up to the required hight, or four courses above the finished line of the roof, the cap flashing B is placed in position, as shown, after which the mason completes the wall and sets the coping. The base flashing A, having a lock as indicated, is turned up under the cap B to within ½ inch of the top of the cap flashing.

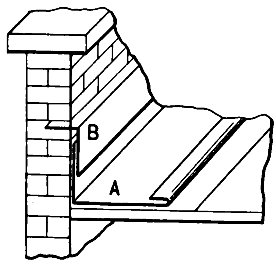


Fig. 22.—A Cap and Base Flashing to Allow Expansion and Contraction.

FINISHING AROUND SKYLIGHTS AND SCUTTLES.

It often occurs that a skylight or scuttle is placed in a roof, the curb of which must be flashed and the corners double seamed, as shown in Fig. 23, A representing the scuttle opening and B C D E the curb, the water running in the direction of the arrow. Then the corners should be double seamed, as shown in diagram F, and the locks made so that when closed, as at *a*, the water com-

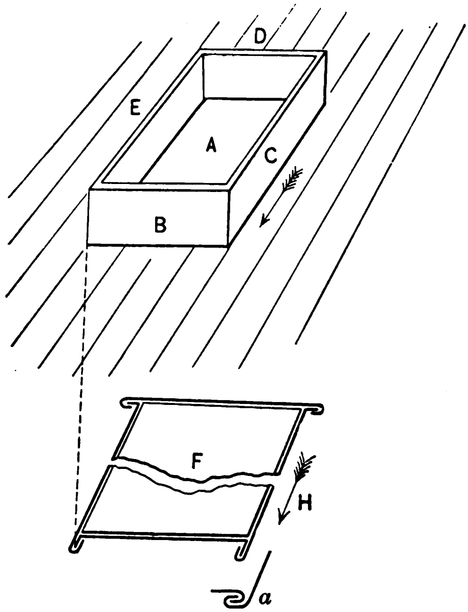


Fig. 23.—Double Seaming Corners.

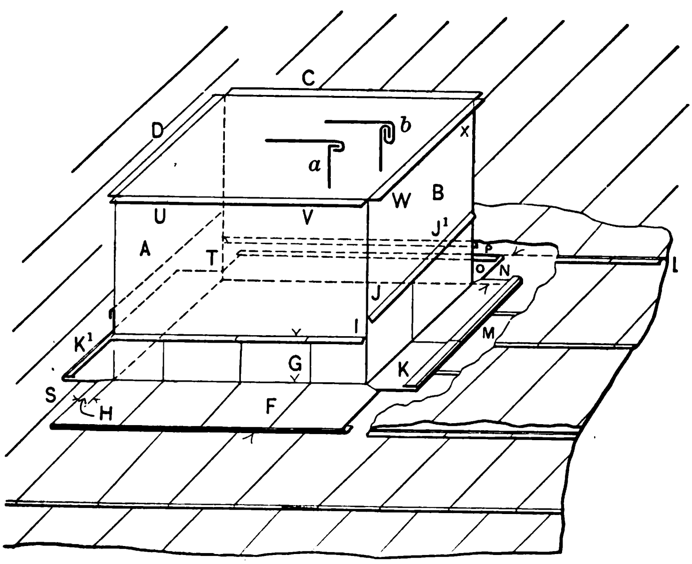


Fig. 24 - Flashing Around a Structure on a Roof.

ing in the direction of the arrow H, will pass over the seam. If the seams were made in the opposite manner the water would run into the joints. This shows how to seam the corners and flash around a curb or bulkhead or any other structure on a roof. The method of obtaining the correct seam lines on the front, sides and back is shown in Fig. 24 and is applicable to curbs, scuttles, chimneys, etc. A B C D represents a bulkhead over a roof around which flashing must be placed, the sides and top to be covered with tin. E represents the last course of tin, which is laid before reaching the bulkhead. To put in the strip F G, assuming that the distance from the lock to the bulkhead indicated by F is 10 inches, bend off 10 inches on the strip, as shown in Fig. 17, making the distance of G in Fig. 24 4 inches, using 14 x 20 inch tin. When the strip is bent up it is notched at the corners to allow for double seaming, as shown at F in Fig. 23, notching the corners, Fig. 24, so that the portion H forms a lap on the roof, and to be pieced out later. The side strips K and K^1 are now put in position, care being taken that the lock J of the side strip K runs above and breaks joints with the lock I of the front strip F G.

The tin roof is now continued up to L, or the first seam above the bulkhead, the flat portion at M being broken in the diagram to better illustrate the locks. The line of the seam L is now extended with pencil, as shown by the dotted line, so that the proper measurement of the distance from the bulkhead to the lock L can be obtained, as at N. Bend off the rear strip O so that the lock P will be in line with the lock L, exercising care that the lock J^1 on the strip turned up against the bulkhead will break joints with the lock J on the side strips. The roofing is now continued from the locks L P, after which the corners N R S T are pieced out and soldered.

COVERING THE SIDES AND TOP OF BULKHEADS.

The sides of the bulkhead are tinned up in the usual manner, allowing edges for double seaming at the corners, and allowing a single edge at the top, as indicated by U V W X C D, Fig. 24. Then, when covering the top of the bulkhead, the roof is locked into the single edges U V W X C and D, as shown at *a*, and is

then turned over to form a double lock, as at *b*. The corners are now double seamed, soldering the lower part 6 inches above the roof line, while the balance of the seams at the corners and sides are painted with a thick coat of red lead. After this they are flattened or closed with the mallet, which insures a tight joint.

FLASHING PARAPET WALL.

Fig. 25 illustrates the flashing of a parapet wall, with tube connected through this wall. A B indicates the wall, C the outside

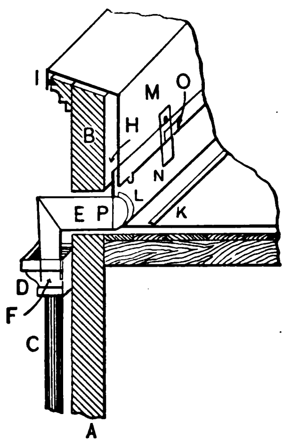


Fig. 25.—Flashing Around a Tube and Over a Parapet Wall.

leader, and D the head. The tube E is placed in position, having an elbow, and entering the leader head as at F. The tube is flanged out, and the base strip K L put in position as shown, cutting out the opening for the tube and soldering heavily around the flange of the tube. A wire strainer or vertical wires are now soldered across the opening, as shown at P. The base flashing extends upward as high as H. The metal covering of the parapet B is in this case to form a cap flashing lapping over the base flashing as much as J and being turned over the wood mold at the top and nailed at I.

When a cap flashing of this kind is required, some workmen use a soldering copper and solder and tack the cap to the base at

intervals. This method requires much time and solder and even then does not give satisfaction; a better method is to fasten the cap by means of a cleat made of heavy tin, which is quicker and gives room for expansion and contraction. This is done by using scrap tin about 1 inch wide and 1 inch longer than the cap overlap of the base, as shown by M. The cleat is now nailed above the base flashing, as illustrated, and the edge N, which projects below the cap, is turned over and closed, as shown at O.

SOLDERING UPRIGHT SEAMS.

We will now consider the soldering of upright seams, which becomes necessary when cross seams occur in side or wall flashings or when the corners of curbs or chimneys have to be soldered. Fig. 26 illustrates a cross seam in a side wall flashing, A B indi-

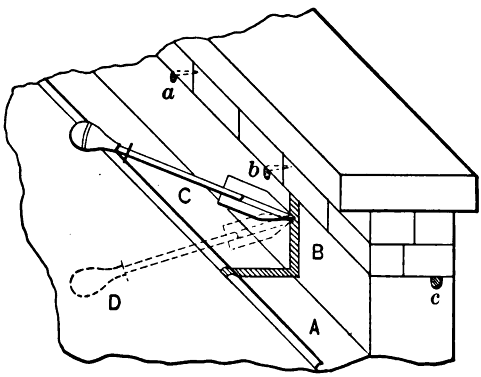


Fig 26.—Soldering Upright Seam.

cating the metal flashings fastened to the wall joint by the wall hooks *a b* and *c*. The seam being properly locked and closed, it should be soldered in the following manner: First, prepare or forge the soldering coppers, as in Fig. 4; the front A is wedge shaped, ¼ inch thick by about 1¼ inches wide, and is used for upright seam work. This style of soldering coppers should be tinned on one side and on the end only; if tinned otherwise the solder, instead of remaining on the tinned side, would flow downward; by tinning the copper on one side only the remaining sides

will be black and will not tend to draw the solder downward. The soldering copper being thus prepared, we will solder the upright seams in the manner indicated in Fig. 26, holding the copper in the position shown by C. This allows the solder to flow forward, while if the copper were held as shown by the dotted line D, the solder would flow backward and away from the seam. First the seams are tacked, in order that they will lie close; then the seam is thoroughly soaked with solder, after which ridges of solder are placed across to strengthen it. In "soaking" the seam the copper should be placed directly over the lapped part, so that the metal is thoroughly heated. This enables the solder to flow between the seams of the metal, making a tight joint. The same method applies to any other upright seam.

Standing Seam Roofing.

EDGING THE STRIPS.

We will now give attention to the method of laying standing seam roofing, in which the cross horizontal seams are locked as in flat seam roofing and whose vertical seams are standing and locked, as will be described in connection with Figs. 29 to 31 inclusive. Assuming that the pitch of the roof is 18 feet long, the tin is edged on the 14-inch side only, right and left, and as many sheets are locked together as are required for the 18-foot pitch.

After the necessary number of strips have been locked and soldered, the standing seams are bent up with the tongs, or, what is better and quicker, the roofing edger for standing seam roofing. This is a machine into which the strips of tin are fed, being discharged in bent up form as required and as shown in Fig. 27, 1

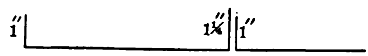


Fig. 27.—Edged Strips Laid for Lock Seam.

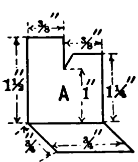


Fig. 28.—Cleat for Fastening Strips to Roof.

inch on the one side and 1¼ inches on the other, or they can be bent 1¼ inches on the one side and 1½ inches on the other, as is most desirable. This gives a ¾-inch finished seam in the first case and 1 inch in the second when completed.

CLEATS FOR HOLDING THE STRIPS.

In laying the strips they are fastened by means of cleats, shown in Fig. 28, with full size measurements. These cleats

allow for expansion and contraction of the metal, and are applied as shown in Fig. 29, which also shows the first operation in applying standing lock roofing. Some roofers use cleats which are not notched out, as is indicated at A in Fig. 28, but cut the cleat square at the top, and instead of turning the cleat right and left, as in Fig. 29, they only turn the cleat over the strip B, the strip C not being secured until the second operation is performed, as in Fig. 30.

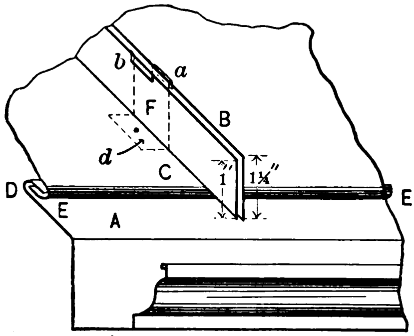


Fig. 29.—First Operation.

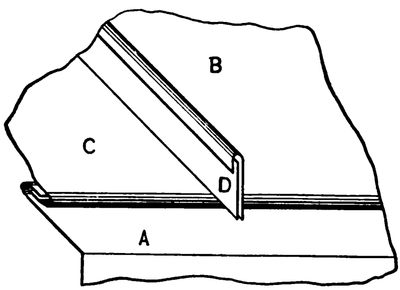


Fig. 30.—Second Operation.

However, by turning the cleat as shown in Fig. 29 both sides of the strips are held down and trouble from the wind is avoided.

Assuming that all the strips have been bent up 1 and 1¼ inches, apply them to the roof boards as follows: Let A represent the hanging gutter at the eave of the pitch roof, having a lock bent on it, as at D. Take a strip of tin, B, having a lock at the bot-

tom, as at E E, and lock it well into the lock of the gutter, as shown. Then with a cleat made of scrap tin, Fig. 28, place it as indicated in Fig. 29 by F. Lay it tight against the upright bend of the strip B and fasten it with a roofing nail at *d*. Now turn the edge of the cleat F over the tin strip, as shown at *a*; this holds the strip B in position. It is usual to place these cleats about 20 inches apart, and in some cases they are placed closer, as desired; sometimes two cleats to a 28-inch sheet. The next strip, C, should have a 1-inch bend. Lay it tight against the 1¼-inch bend of the strip B, lock it well into the lock D of the gutter, press it down well at the corner to the roof, and turn over the edge of the cleat, as at *b*. This holds the strip C in position. It will be noted that no nails have been driven into the standing seam strip, the entire roof depending on the cleats to hold it down and prevent rattling.

The next operation is shown in Fig. 30. By means of the hand seamer and mallet, or with the roofing double seamers, the first or single seam is turned over, as shown at D. If the hand seamer is used it is held in the left hand and the single edge is turned over with the mallet. Roofing double seamers are widely used, and two constitute a set to finish a seam. One of the seamers does the bending and the other the squeezing. Both can be made adjustable for the first or single seam and for the double seam. The operations are performed by the foot treadle, the handles being used to clamp the edges. Much time is saved in the use of the double seamers over that expended in the use of the hand seamers. When the seam D has been tightly closed the double seam is made, as shown at D in Fig. 31, involving the same operations with both the hand and roofing seamers. This is explained in connection with Fig. 30.

FINISHING STANDING SEAMS AT GUTTER.

If desired the seam E, in Fig. 31, can be soldered, but this is unnecessary on a steep roof, as the water will not back into the seam. While the three operations shown in the three preceding figures indicate the method of double seaming, another method of locking the standing seam roof into the gutter edge is shown in Fig. 32, in which the standing seam is flattened and locked into the gutter, as shown.

Fig. 33 illustrates a roof starting at the eave and having a hanging gutter and gable wall flashing. A indicates the gutter flanged to the roof, as shown at B, allowing the flange B to extend

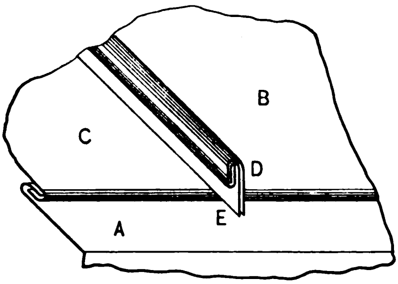


Fig. 31.—Last Operation.

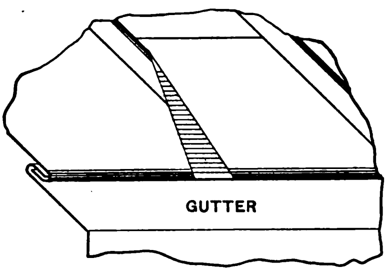


Fig. 32.—Finishing a Standing Seam Roof at Gutter.

under the side flashing F, as at C. At the front of the parapet wall notch out the flange of the gutter, and bend it up against the wall, as indicated by the dotted line D. When the gutter is in position and the gutter braces fastened to it the side wall or step flashing E F G is put in position, stepping double courses of brick, as shown, and flanging into the joints of the brick work or other wall and fastened with wall hooks and paintskins, and overlapping the gutter flange D, as at H.

CONNECTING FLASHING WITH ROOF.

The strip is flanged outward on the roof, as shown at J, Fig. 33, about 7 inches, or as much as the width of the tin strip will allow,

and on this strip the 1¼-inch bend is made, mitering the flange J over the flange B of the gutter, as shown at I. The ten strips K L M are now placed in the positions indicated, using the cleat N, as in Fig. 29, and also shown by *c d e* in Fig. 33. Care should be taken to lock the strips well at the bottom into the lock of the gutter flange B, as is indicated by *a b*. O is the wire strainer or basket placed over the leader P. The entire roof is finished in the manner indicated, when the double seaming is done, as previously explained.

MAKING A MITERED STANDING RIDGE SEAM.

Fig. 34 illustrates a finish made at the ridge of a standing seam roof. This is known as a comb ridge. A B indicates a section of

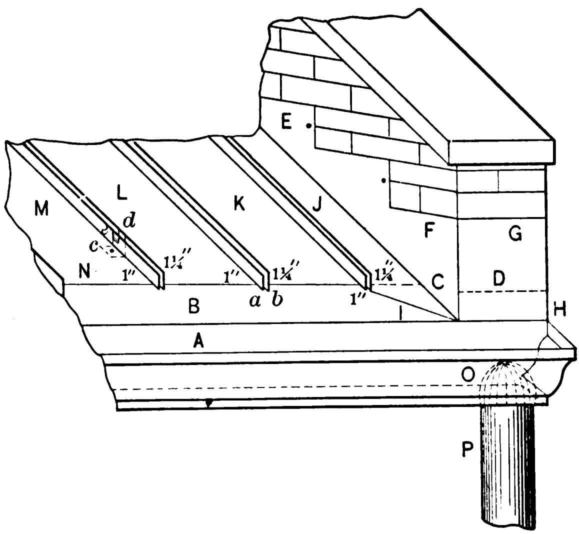


Fig. 33.—Standing Seam Roofing, Laying the Strips.

the roof boards, C D and E are strips of tin having a single edge at the ridge, as shown by I, while the opposite strips F G and H have a double edge at the ridge, as at J. The standing seams K L M are mitered and are soldered from K to *a*, L to *b* and M to *c*. When the comb ridge is not required it can be double seamed, as

at A in Fig. 35, leaving the standing seam miter at B C and D, and soldering from B to *b*, C to *c* and D to *d*.

When mitering the standing seams at the top it is better and quicker to make a small "gauge" with which to mark each strip at the top after the standing seams are turned up. This "gauge," or shape, can be made as follows: In Fig. 36, A represents a piece of the tin strip in use before being bent up and about 12 inches long. Obtain the angle of the roof at the ridge, as in diagram B

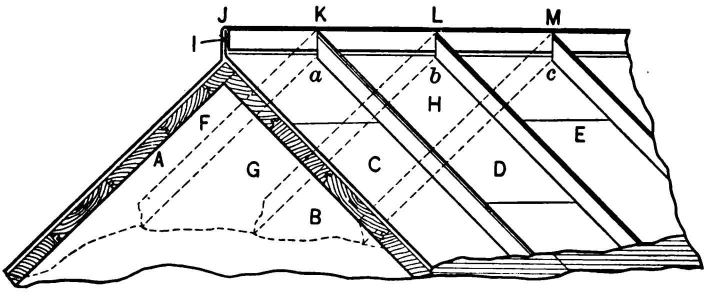


Fig 34 - Finishing with a Comb Ridge.

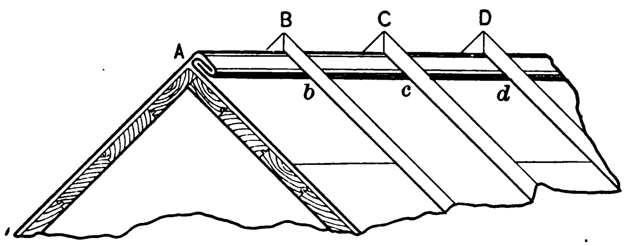


Fig. 35.—Double Seaming the Ridge.

C. Parallel to C and B measure off a distance of 1¼ inches and draw the lines D E and E F; then draw a line from E to H, after which take a tracing of H E F J, to be placed as shown by L M K; repeat the operation at N. Allow for the vertical seam O, as shown. The dotted line P indicates the allowance for the double seam. Then all the tin strips for one side of the roof should be cut without laps, as shown by L M O N. The tin strips for the opposite side should have laps for seaming, as in Fig. 37. This figure

exhibits the top of the strip bent up and having laps. In Fig. 38 is shown another form of comb ridge, in which the standing seams are flattened and then turned up the same as in standing seam work, by means of tongs, and double seamed with the hand seamer, as shown in the illustration.

Fig. 39 shows the method of finishing the standing seam when it butts against the wall and it is desired to put in a flashing. In this case proceed as follows: A represents the roof boards, B and C tin strips put in position, and having a lock as at E and D, the

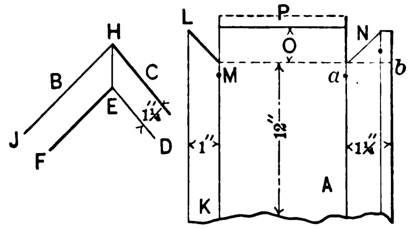


Fig. 36.—Gauge for Cutting End of Strip to Fit Comb.

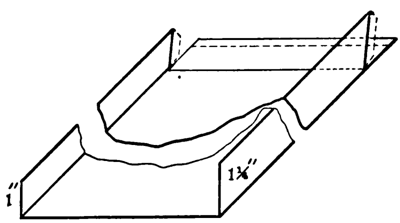


Fig. 37.—Roofing Strip Cut to Fit Comb.

distance from the wall to the lock being as desired. It will be noticed that the standing seam H is turned over by means of a mallet, as shown at J, after which the flashing F G is locked into it, as at K. Then the seam K is tightly closed with the mallet and the seam K H soldered. If the roof is steep the soldering is not necessary. The top of the flashing is flashed into the wall and fastened with wall hooks, *a b c* and *d,* and is then paintskinned or cemented.

The method of turning over the double standing seam H, as shown at J, is sometimes employed where the seams meet at the

ridge, as at B C and D in Fig. 35. Then they should be cut square, as at *a b* in Fig. 36, and turned over, as shown by J in Fig. 39. Double seam and solder at the ridge, as at A in Fig. 35. It may be useful to know that 2½ squares constitute a day's work of eight hours in large cities.

STEP FLASHING.

Fig. 40 illustrates the method of putting in a full step flashing in connection with a hanging gutter on a pitched roof. This

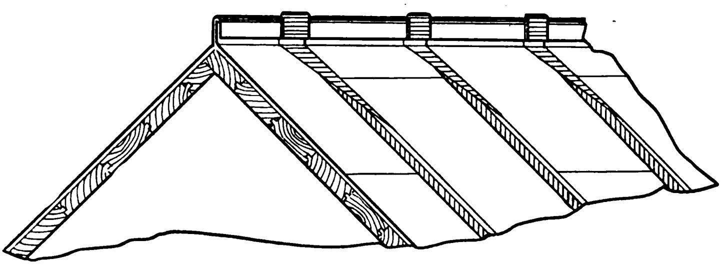


Fig. 38.—Ridge Comb Finished with Standing Seam.

method is applied when the roof is of flat seam, standing seam, slate or shingles. A shows the roof boards, B the gable wall and C D the gutter flanging on the roof at E, with a lock at F. The lock is notched and the flange of the gutter extended flat, as at H, and bending up against the wall, as at J. K shows the step flashings turning around the head of the wall at L and overlapping the flange of the gutter J, as at M. The side flashing flanges out on the roof, as at N, with a lock on it, joining the gutter flange at H. All of the locks are fastened by means of the cleats O and P.

Flanges are allowed to flash into the wall at *a b c* and *d*, while the vertical seam is nailed in the joint at *e* and *f* and cemented.

When the roof is laid with flat seam the sheets are locked, as indicated, the same as in flat seam roofing, while if the roof is of standing seam, and it is not desired to put a standing lock on to the side strip, as shown in Fig. 33 by J, a lock would be placed as shown by N in Fig. 40, and the tin strip of the standing seam roofing locked into it.

If the roof is very steep and we are called upon to prepare the

flashings for a slate or shingle roof, the same method would be employed in flashing as shown in Fig. 40, making the lock N about ½ inch; then the slates or shingles would be laid directly against the wall and over the locks, allowing the flashing to project 8 inches. If this is done the rain can get under the slates or shingles only as far as the lock N, and run into the gutter. Care should be taken in using slate or shingles for roofing that the lock N of the side flashing K extends down to the edge of the gutter, as shown by the dotted lock R.

Another phase of the tinner's work is the preparing of flashings for slate or shingle roofs, which subject will be considered in the next chapter.

Flashings for Slate or Shingle Roofs.

WALL FLASHING.

In Fig. 41 A is the roof surface, B the side or gable wall and C D the half round hanging gutter, which last should be flashed up under the shingles or slates at least 8 inches, as indicated by the dotted line E F, and against the end of the gable wall, as at G. A corner flashing should be joined to G and E F, as shown by the dotted line E^1, on the side of the wall. This being done, the braces H I, etc., are fastened to the front of the gutter and screwed to the roof board. The slater or shingler then lays

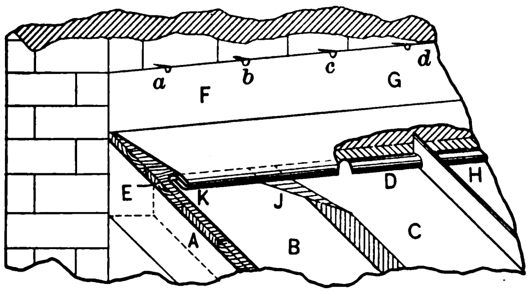


Fig. 39.—Flashing Against a Wall..

his eave course, the tinner furnishing him with shingle flashings, which are made of tin and painted before being applied. They are to be bent up 2½ inches on each side and in length 2½ inches more than the slates or shingles are laid to the weather.

SHINGLE FLASHING.

The shingle flashing is laid on the eave course and over the same. The courses are then laid in order, the flashings being put in with every course, as indicated by X X, etc., or as is better shown at J, which illustrates the flashing overlapping the previous flashing K, the bottom O of the flashing J running within ½ inch of the bottom line of the slate or shingle R.

When the roof has been covered the tinner puts on the counter

or cap flashings L M, flashing into the joints of the brick work and continuing around the end of the brick wall P, overlapping the shingle and gutter flashings. If desired the cap flashing can be made in small pieces, having seams at *a* and *b*, which saves material.

PUTTING IN A VALLEY.

A valley is put in on a pitched roof, the covering of which is not of metal, as shown in Fig. 42, A and B representing the roof surface, D and E the gutter, flanged on the roof 8 inches, and F G the valley, flanging 7 inches on the roof on each side, and having

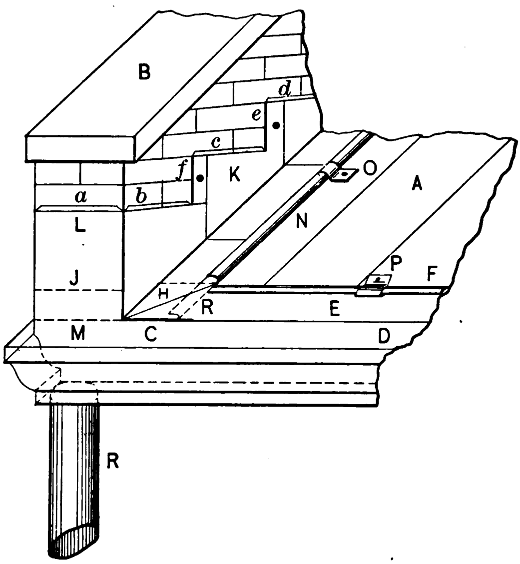


Fig. 40.—Putting in Step Flashings for Pitched Roof with Hanging Gutter.

a water lock or drip at H and I. The valley is laid from the bottom up, overlapping the gutter flange, as at H and I. If it is laid in lengths, as is usual, say of from 7 to 8 feet, the joint should be overlapped 2 inches, as at J K, running the valley to the top of the ridge. Care must be taken in fastening the valley not to nail through it, otherwise a leak will occur. Cleats should be used, as at L, so that when the slates or shingles are laid over the valley

and the water flows down the lock prevents the water from going sideways and causing a leak, whereas if nails were driven direct into the valley a leak would occur at once.

FLASHING AROUND A CHIMNEY.

Fig. 43 shows the flashing just around a chimney or other structure passing through the roof, where the covering is slate,

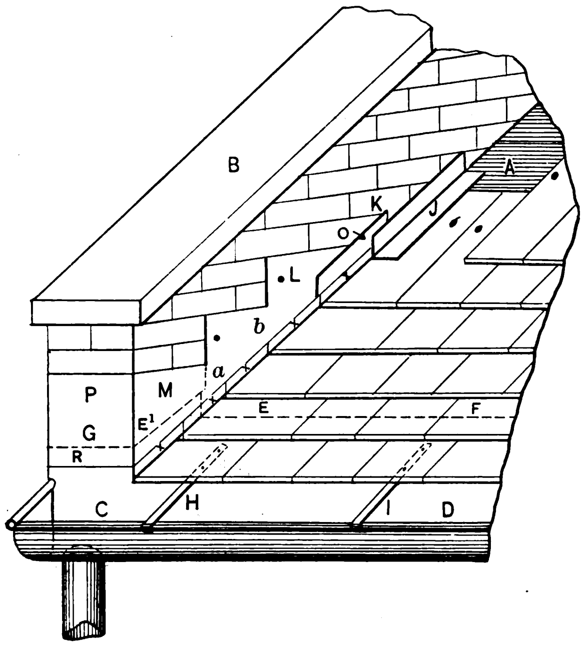


Fig. 41.—Putting in Step and Counter or Cap Flashing for Shingle or Slate Roof.

tile or shingle. This method also applies to metal roofs, with the exception that the flashing is locked and soldered on the metal roofing, while in this case it is flashed over and under the roof covering of slate or shingle.

Referring to the diagram, A B represents the line of the roof, and C the last course of slate or shingle, butting against the bottom of the chimney. The flashing D is now put in, the lower flange being made wide enough to cover the nail heads, and the

top is flanged into the joints of the brick work. The roof covering being continued, the side flashing E is put in, using shingle

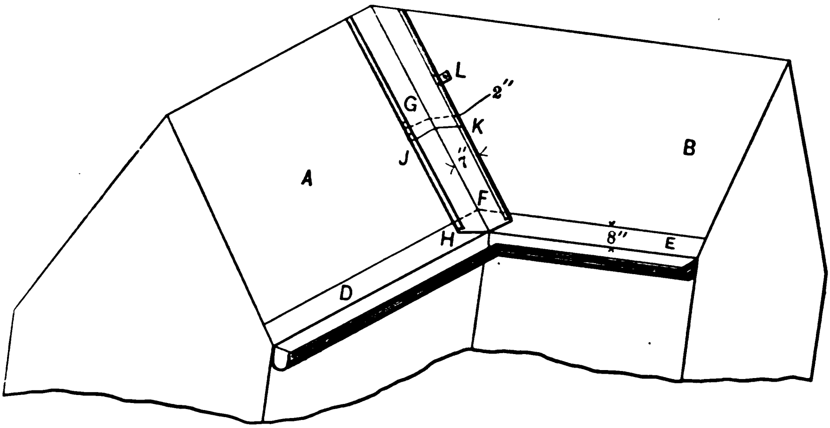


Fig. 42.—Laying a Valley on a Pitched Roof.

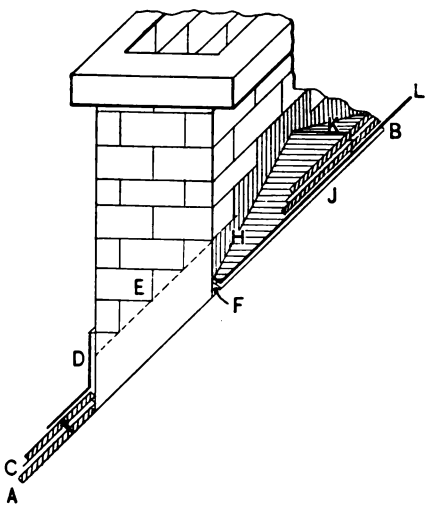


Fig. 43.—Flashing Around a Chimney on a Shingle Roof, Showing Cant Board in Rear.

and cap flashing, in the same manner as described in connection with Fig. 41.

When the back of the chimney is reached a cant board or saddle is put in by the carpenter, in order to throw the water to either side. This board is then covered with metal, as shown by H K, stepping into the brick joints and flanging upward on the roof at least 18 inches above the top of the saddle K, to prevent any leaks resulting from a snow storm. A chimney in a roof, as illustrated, always forms a pocket when the snow slides; and if

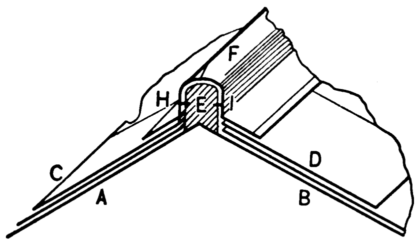


Fig. 44.—Capping the Ridge or Hip of Shingle Roofs.

the flange F J L is not carried high enough the snow in melting will suck under the flashing and cause a bad leak.

Fig. 44 shows how the capping is placed over the ridge of the roof, A B illustrating the pitch and C and D the last course of slate or shingle. The metal capping or ridge F, having aprons, is fastened to the wooden core E by means of wood screws H and I, resulting in a tight joint.

QUANTITY OF TIN FOR ROOFS.

Giving the number of boxes and sheets required to cover roofs of various sizes, ranging from 10 to 10,000 square feet.

SURFACE OF ROOF TO BE COVERED	FLAT SEAM								STANDING SEAM																							
	Edged ¼ in.				Edged ⅜ in				Single Lock								Double Lock															
									¾-in. seam.				1-in. seam.				¾-in. seam.				1-in. seam.											
	Covering space 13 x 19 in. Exposing surface 247 sq. in.		Covering space 19 x 27 in. Exposing surface 513 sq. in		Covering space 12⅞ x 18⅞ in. Exposing surface 243 31/64 sq. in.		Covering space 18⅞ x 26⅞ in. Exposing surface 507 17/64 sq in.		Covering 228 17/32 sq. in. Edged 1 and 1¼ in.		Covering 477 1/32 sq. in. Edged 1 and 1¼ in.		Covering 222 9/32 sq. in. Edged 1¼ and 1½ in.		Covering 463 19/32 sq. in. Edged 1¼ and 1½ in.		Covering 226 63/64 sq. in. Edged 1 and 1¼ in.		Covering 471 21/64 sq. in. Edged 1 and 1¼ in.		Covering 216 45/64 sq in. Edged 1¼ and 1½ in.		Covering 458 13/64 sq. in. Edged 1¼ and 1½ in.													
	14x20		20x28		14x20		20x28		14x20		20x28		14x20		20x28		14x20		20x28		14x20		20x28									
Sq. ft.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.								
10	0	6	0	3	0	6	0	3	0	7	0	4	0	7	0	4	0	7	0	4	0	7	0	4								
11	0	7	0	4	0	7	0	4	0	7	0	4	0	8	0	4	0	8	0	4	0	8	0	4								
12	0	7	0	4	0	8	0	4	0	8	0	4	0	8	0	4	0	8	0	4	0	8	0	4								
13	0	8	0	4	0	8	0	4	0	9	0	4	0	9	0	5	0	9	0	4	0	9	0	5								
14	0	9	0	4	0	9	0	4	0	9	0	5	0	10	0	5	0	10	0	5	0	10	0	5								
15	0	9	0	5	0	9	0	5	0	10	0	5	0	10	0	5	0	10	0	5	0	10	0	5								
16	0	10	0	5	0	10	0	5	0	11	0	5	0	11	0	5	0	11	0	5	0	11	0	6								
17	0	10	0	5	0	11	0	5	0	11	0	6	0	12	0	6	0	11	0	6	0	12	0	6								
18	0	11	0	6	0	11	0	6	0	12	0	6	0	12	0	6	0	12	0	6	0	12	0	6								
19	0	12	0	6	0	12	0	6	0	12	0	6	0	13	0	6	0	13	0	6	0	13	0	6								
20	0	12	0	6	0	12	0	6	0	13	0	7	0	13	0	7	0	13	0	7	0	14	0	7								
21	0	13	0	6	0	13	0	6	0	14	0	7	0	14	0	7	0	14	0	7	0	14	0	7								
22	0	13	0	7	0	14	0	7	0	14	0	7	0	15	0	7	0	15	0	7	0	15	0	7								
23	0	14	0	7	0	14	0	7	0	15	0	7	0	15	0	8	0	15	0	8	0	16	0	8								
24	0	14	0	7	0	15	0	7	0	16	0	8	0	16	0	8	0	16	0	8	0	16	0	8								
25	0	15	0	8	0	15	0	8	0	16	0	8	0	17	0	8	0	17	0	8	0	17	0	8								
26	0	16	0	8	0	16	0	8	0	17	0	8	0	17	0	9	0	17	0	8	0	18	0	9								
27	0	16	0	8	0	16	0	8	0	18	0	9	0	18	0	9	0	18	0	9	0	18	0	9								
28	0	17	0	8	0	17	0	8	0	18	0	9	0	19	0	9	0	19	0	9	0	19	0	9								
29	0	17	0	9	0	18	0	9	0	19	0	9	0	19	0	10	0	19	0	9	0	20	0	10								

	14 x 20		20 x 28		14 x 20		20 x 28		14 x 20		20 x 28		14 x 20		20 x 28		14 x 20		20 x 28		14 x 20		20 x 28	
Sq. ft.	B.	S	B.	S.	B.	S.	B.	S.	B.	S	B.	S	B.	S	B.	S	B.	S.	B.	S	B.	S.	B.	S.
30	0	18	0	9	0	18	0	9	0	19	0	10	0	20	0	10	0	20	0	10	0	20	0	10
31	0	19	0	9	0	19	0	9	0	20	0	10	0	21	0	10	0	21	0	10	0	21	0	10
32	0	19	0	9	0	19	0	10	0	21	0	10	0	21	0	10	0	21	0	10	0	22	0	11
33	0	20	0	10	0	20	0	10	0	21	0	10	0	22	0	11	0	22	0	11	0	22	0	11
34	0	20	0	10	0	21	0	10	0	22	0	11	0	23	0	11	0	22	0	11	0	23	0	11
35	0	21	0	10	0	21	0	10	0	23	0	11	0	23	0	11	0	23	0	11	0	24	0	11
36	0	21	0	11	0	23	0	11	0	23	0	11	0	24	0	12	0	24	0	11	0	24	0	12
37	0	22	0	11	0	22	0	11	0	24	0	12	0	24	0	12	0	24	0	12	0	25	0	12
38	0	23	0	11	0	23	0	11	0	24	0	12	0	25	0	12	0	25	0	12	0	26	0	12
39	0	23	0	11	0	24	0	12	0	25	0	12	0	26	0	13	0	26	0	12	0	26	0	13
40	0	24	0	12	0	24	0	12	0	26	0	13	0	26	0	13	0	26	0	13	0	27	0	13
41	0	24	0	12	0	25	0	12	0	26	0	13	0	27	0	13	0	27	0	13	0	28	0	13
42	0	25	0	12	0	25	0	12	0	27	0	13	0	28	0	14	0	28	0	13	0	28	0	14
43	0	26	0	13	0	26	0	13	0	28	0	13	0	28	0	14	0	28	0	14	0	29	0	14
44	0	26	0	13	0	27	0	13	0	28	0	14	0	29	0	14	0	29	0	14	0	30	0	14
45	0	27	0	13	0	27	0	13	0	29	0	14	0	30	0	14	0	30	0	14	0	30	0	15
46	0	27	0	13	0	28	0	14	0	29	0	14	0	30	0	15	0	30	0	15	0	31	0	15
47	0	28	0	14	0	28	0	14	0	30	0	15	0	31	0	15	0	31	0	15	0	32	0	15
48	0	28	0	14	0	29	0	14	0	31	0	15	0	32	0	15	0	31	0	15	0	32	0	16
49	0	29	0	14	0	30	0	14	0	31	0	15	0	32	0	16	0	32	0	15	0	33	0	16
50	0	30	0	15	0	30	0	15	0	32	0	16	0	33	0	16	0	33	0	16	0	34	0	16
51	0	30	0	15	0	31	0	15	0	33	0	16	0	34	0	16	0	33	0	16	0	34	0	17
52	0	31	0	15	0	31	0	15	0	33	0	16	0	34	0	17	0	34	0	16	0	35	0	17
53	0	31	0	15	0	32	0	16	0	34	0	16	0	35	0	17	0	35	0	17	0	36	0	17
54	0	32	0	16	0	32	0	16	0	35	0	17	0	36	0	17	0	35	0	17	0	36	0	17
55	0	33	0	16	0	33	0	16	0	35	0	17	0	36	0	18	0	36	0	17	0	37	0	18
56	0	33	0	16	0	34	0	16	0	36	0	17	0	37	0	18	0	37	0	18	0	38	0	18
57	0	34	0	16	0	34	0	17	0	36	0	18	0	37	0	18	0	37	0	18	0	38	0	18
58	0	34	0	17	0	35	0	17	0	37	0	18	0	38	0	19	0	38	0	18	0	39	0	19
59	0	35	0	17	0	35	0	17	0	38	0	18	0	39	0	19	0	39	0	19	0	40	0	19
60	0	35	0	17	0	36	0	18	0	38	0	19	0	39	0	19	0	39	0	19	0	40	0	19
61	0	36	0	18	0	37	0	18	0	39	0	19	0	40	0	19	0	40	0	19	0	41	0	20
62	0	37	0	18	0	37	0	18	0	40	0	19	0	41	0	20	0	41	0	19	0	42	0	20
63	0	37	0	18	0	38	0	18	0	40	0	20	0	41	0	20	0	41	0	20	0	43	0	20
64	0	38	0	18	0	38	0	19	0	41	0	20	0	42	0	20	0	42	0	20	0	43	0	21
65	0	38	0	19	0	39	0	19	0	41	0	20	0	43	0	21	0	42	0	20	0	44	0	21
66	0	39	0	19	0	40	0	19	0	42	0	20	0	43	0	21	0	43	0	21	0	44	0	21
67	0	40	0	19	0	40	0	20	0	43	0	21	0	44	0	21	0	44	0	21	0	45	0	22
68	0	40	0	20	0	41	0	20	0	43	0	21	0	45	0	22	0	44	0	21	0	46	0	22
69	0	41	0	20	0	41	0	20	0	44	0	21	0	45	0	22	0	45	0	22	0	46	0	22
70	0	41	0	20	0	42	0	20	0	45	0	22	0	46	0	22	0	46	0	22	0	47	0	22
71	0	42	0	20	0	43	0	21	0	45	0	22	0	47	0	23	0	46	0	22	0	48	0	23
72	0	42	0	21	0	43	0	21	0	46	0	22	0	47	0	23	0	47	0	22	0	48	0	23
73	0	43	0	21	0	44	0	21	0	46	0	23	0	48	0	23	0	48	0	23	0	49	0	23
74	0	44	0	21	0	44	0	22	0	47	0	23	0	48	0	23	0	48	0	23	0	50	0	24
75	0	44	0	22	0	45	0	22	0	48	0	23	0	49	0	24	0	49	0	23	0	50	0	24
76	0	45	0	22	0	46	0	22	0	48	0	23	0	50	0	24	0	50	0	24	0	51	0	24
77	0	45	0	22	0	46	0	22	0	49	0	24	0	50	0	24	0	50	0	24	0	52	0	25
78	0	46	0	22	0	47	0	23	0	50	0	24	0	51	0	25	0	51	0	24	0	52	0	25
79	0	47	0	23	0	47	0	23	0	50	0	24	0	52	0	25	0	52	0	25	0	53	0	25

SURFACE OF ROOF TO BE COVERED	FLAT SEAM								STANDING SEAM.															
	Edged ¼ in.				Edged ⅜ in.				Single Lock								Double Lock							
									¾-in. seam.				1-in. seam.				¾-in. seam.				1-in. seam.			
	Covering space 13 x 19 in. Exposing surface 247 sq. in.		Covering space 19 x 27 in. Exposing surface 513 sq. in.		Covering space 12⅞ x 18⅞ in. Exposing surface 243 1/64 sq. in.		Covering space 18⅞ x 26⅞ in. Exposing surface 507 17/64 sq. in.		Covering 228 17/32 sq. in. Edged 1 and 1¼ in.		Covering 477 1/32 sq. in. Edged 1 and 1¼ in.		Covering 222 3/32 sq. in. Edged 1¼ and 1½ in.		Covering 463 19/32 sq. in. Edged 1¼ and 1½ in.		Covering 222 63/64 sq. in. Edged 1 and 1¼ in.		Covering 471 21/64 sq. in. Edged 1 and 1¼ in.		Covering 216 45/64 sq. in. Edged 1¼ and 1½ in.		Covering 458 13/64 sq. in. Edged 1¼ and 1½ in.	
	14x20		20x28		14x20		20x28		14x20		20x28		14x20		20x28		14x20		20x28		14x20		20x28	
Sq. ft.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.
80	0	47	0	23	0	48	0	23	0	51	0	25	0	52	0	25	0	52	0	25	0	54	0	26
81	0	48	0	23	0	48	0	23	0	52	0	25	0	53	0	26	0	53	0	25	0	54	0	26
82	0	48	0	24	0	49	0	24	0	52	0	25	0	54	0	26	0	53	0	26	0	55	0	26
83	0	49	0	24	0	50	0	24	0	53	0	26	0	54	0	26	0	54	0	26	0	56	0	27
84	0	49	0	24	0	50	0	24	0	53	0	26	0	55	0	27	0	55	0	26	0	56	0	27
85	0	50	0	24	0	51	0	25	0	54	0	26	0	56	0	27	0	55	0	26	0	57	0	27
86	0	51	0	25	0	51	0	25	0	55	0	26	0	56	0	27	0	56	0	27	0	58	0	28
87	0	51	0	25	0	52	0	25	0	55	0	27	0	57	0	28	0	57	0	27	0	58	0	28
88	0	52	0	25	0	53	0	25	0	56	0	27	0	58	0	28	0	57	0	27	0	59	0	28
89	0	52	0	26	0	53	0	26	0	57	0	27	0	58	0	28	0	58	0	28	0	60	0	28
90	0	53	0	26	0	54	0	26	0	57	0	28	0	59	0	28	0	59	0	28	0	60	0	29
91	0	54	0	26	0	54	0	26	0	58	0	28	0	60	0	29	0	59	0	28	0	61	0	29
92	0	54	0	26	0	55	0	27	0	58	0	28	0	60	0	29	0	60	0	29	0	62	0	29
93	0	55	0	27	0	56	0	27	0	59	0	29	0	61	0	29	0	61	0	29	0	62	0	30
94	0	55	0	27	0	56	0	27	0	60	0	29	0	61	0	30	0	61	0	29	0	63	0	30
95	0	56	0	27	0	57	0	27	0	60	0	29	0	62	0	30	0	62	0	30	0	64	0	30
96	0	56	0	27	0	57	0	28	0	61	0	29	0	63	0	30	0	62	0	30	0	64	0	31
97	0	57	0	28	0	58	0	28	0	62	0	30	0	63	0	31	0	63	0	30	0	65	0	31
98	0	58	0	28	0	59	0	28	0	62	0	30	0	64	0	31	0	64	0	30	0	66	0	31
99	0	58	0	28	0	59	0	29	0	63	0	30	0	65	0	31	0	64	0	31	0	66	0	32
100	0	59	0	29	0	60	0	29	0	64	0	31	0	65	0	32	0	65	0	31	0	67	0	32
200	1	5	0	57	1	7	0	57	1	15	0	61	1	18	0	63	1	18	0	62	1	21	0	63
300	1	63	0	85	1	66	0	86	1	78	0	91	1	83	0	94	1	82	0	92	1	88	0	95
400	2	10	1	1	2	14	1	2	2	29	1	9	2	36	1	13	2	35	1	11	2	42	1	14
500	2	68	1	29	2	73	1	30	2	92	1	39	2	101	1	44	2	99	1	41	2	109	1	46
600	3	14	1	57	3	20	1	59	3	43	1	70	3	54	1	75	3	52	1	72	3	63	1	77
700	3	73	1	85	3	79	1	87	3	106	1	100	4	6	1	106	4	5	1	102	4	18	1	108
800	4	19	2	1	4	27	2	3	4	57	2	18	4	71	2	25	4	69	2	21	4	84	2	28
900	4	77	2	29	4	86	2	32	5	8	2	48	5	24	2	56	5	22	2	51	5	39	2	59
1000	5	23	2	57	5	33	2	60	5	71	2	78	5	89	2	87	5	86	2	82	5	105	2	91

	14 x 20		20 x 28		14 x 20		20 x 28		14 x 20		20 x 28		14 x 20		20 x 28		14 x 20		20 x 28		14 x 20		20 x 28	
Sq. ft.	B.	S.	B.	S.	B.	S.	B.	S.	B	S.	B	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.	B.	S.
1100	5	82	2	85	5	92	2	89	6	22	2	109	6	42	3	6	6	39	3	0	6	59	3	10
1200	6	28	3	1	6	40	3	5	6	85	3	27	6	107	3	37	6	103	3	31	7	14	3	42
1300	6	86	3	29	6	99	3	34	7	36	3	57	7	59	3	68	7	56	3	62	7	80	3	73
1400	7	33	3	57	7	46	3	62	7	99	3	87	8	12	3	99	8	9	3	92	8	35	3	104
1500	7	91	3	86	7	105	3	90	8	50	4	5	8	77	4	18	8	73	4	11	8	101	4	24
1600	8	37	4	2	8	53	4	7	9	1	4	35	9	30	4	49	9	26	4	41	9	56	4	55
1700	8	96	4	30	9	0	4	35	9	64	4	66	9	95	4	81	9	90	4	72	10	10	4	87
1800	9	42	4	58	9	59	4	63	10	15	4	96	10	48	5	0	10	43	4	102	10	77	5	6
1900	9	100	4	86	10	6	4	92	10	78	5	14	11	0	5	31	10	108	5	21	11	31	5	38
2000	10	46	5	2	10	66	5	8	11	29	5	44	11	65	5	62	11	60	5	51	11	97	5	69
2100	10	105	5	30	11	13	5	37	11	92	5	74	12	18	5	93	12	13	5	82	12	52	5	100
2200	11	52	5	58	11	72	5	65	12	43	5	105	12	83	6	12	12	77	6	0	13	6	6	20
2300	11	110	5	86	12	19	5	93	12	106	6	23	13	36	6	48	13	30	6	31	13	73	6	51
2400	12	36	6	2	12	79	6	10	13	57	6	53	13	101	6	74	13	94	6	61	14	27	6	83
2500	13	2	6	30	13	26	6	38	14	8	6	83	14	53	6	105	14	47	6	92	14	94	7	2
2600	13	60	6	58	13	85	6	67	14	71	7	1	15	6	7	24	15	0	7	11	15	48	7	34
2700	14	7	6.	86	14	32	6	95	15	22	7	32	15	71	7	55	15	64	7	41	16	3	7	65
2800	14	65	7	2	14	92	7	11	15	85	7	62	16	24	7	86	16	17	7	72	16	69	7	96
2900	15	11	7	31	15	39	7	40	16	36	7	92	16	89	8	5	16	81	7	102	17	24	8	16
3000	15	69	7	59	15	98	7	68	16	99	8	10	17	42	8	36	17	84	8	21	17	90	8	47
3100	16	16	7	87	16	45	7	97	17	50	8	40	17	106	8	67	17	98	8	51	18	44	8	79
3200	16	74	8	3	16	105	8	13	18	1	8	70	18	59	8	98	18	51	8	82	18	111	8	110
3300	17	20	8	31	17	52	8	41	18	64	8	101	19	12	9	18	19	4	9	0	19	65	9	30
3400	17	78	8	59	17	111	8	70	19	15	9	19	19	77	9	49	19	68	9	31	20	20	9	61
3500	18	25	8	87	18	58	8	98	19	78	9	49	20	30	9	80	20	21	9	61	20	86	9	92
3600	18	83	9	3	19	6	9	14	20	29	9	79	20	95	9	111	20	85	9	92	21	41	10	12
3700	19	30	9	31	19	65	9	43	20	92	9	109	21	48	10	30	21	38	10	11	21	107	10	43
3800	19	88	9	59	20	12	9	71	21	43	10	28	22	0	10	61	21	103	10	41	22	62	10	75
3900	20	35	9	87	20	71	9	100	21	106	10	58	22	65	10	92	22	55	10	72	23	16	10	106
4000	20	92	10	3	21	19	10	16	22	57	10	88	23	18	11	11	23	8	10	102	23	82	11	26
4100	21	39	10	31	21	78	10	44	23	8	11	6	23	83	11	42	23	72	11	21	24	37	11	57
4200	21	97	10	59	22	25	10	73	23	71	11	36	24	36	11	73	24	25	11	51	24	103	11	88
4300	22	44	10	88	22	85	10	101	24	22	11	67	24	101	11	104	24	89	11	82	25	58	12	8
4400	22	102	11	4	23	32	11	18	24	85	11	97	25	53	12	23	25	42	12	0	26	12	12	39
4500	23	48	11	32	23	91	11	46	25	36	12	15	26	6	12	54	25	107	12	31	26	79	12	71
4600	23	107	11	60	24	38	11	74	25	99	12	45	26	71	12	85	26	59	12	61	27	33	12	102
4700	24	53	11	85	24	98	11	103	26	50	12	75	27	24	13	4	27	12	12	92	27	100	13	22
4800	24	111	12	4	25	45	12	19	27	1	12	105	27	89	13	35	27	76	13	10	28	54	13	53
4900	25	57	12	37	25	104	12	48	27	64	13	24	28	42	13	67	28	29	13	41	29	9	13	84
5000	26	4	12	60	26	51	12	76	28	15	13	54	28	106	13	98	28	93	13	72	29	75	14	4
6000	31	27	15	5	31	84	15	24	33	85	16	20	34	83	16	72	34	67	16	41	35	67	16	94
7000	36	50	17	62	37	4	17	84	39	43	18	98	40	59	19	47	40	41	19	10	41	60	19	72
8000	41	73	20	7	42	37	20	32	45	1	21	63	46	36	22	21	46	15	21	92	47	52	22	51
9000	46	95	22	65	47	70	22	91	50	72	24	29	52	12	24	108	51	101	24	61	53	45	25	29
10000	52	6	25	8	52	102	25	39	56	30	26	107	57	100	27	83	57	74	27	31	59	37	28	7

BASIS OF CALCULATION.

Flat Seams Edged One-quarter Inch.

This table is calculated on a basis of ¼-inch edges on 14 x 20 and 20 x 28 sheets, consuming about 1 inch, covering a space 13 x 19 and 19 x 27 inches and exposing a surface of 247 and 513 square inches respectively.

Flat Seams Edged Three-eighths Inch.

This table is calculated on a basis of ⅜-inch edges on 14 x 20 and 20 x 28 sheets, consuming 1⅛ inches, covering a space 12⅞ x 18⅞ and 18⅞ x 26⅞ inches and exposing a surface of $243^1/_{64}$ and $507^{17}/_{64}$ square inches respectively.

Standing Seam, Single Lock.

This table is calculated on the basis of ⅜-inch single lock cross seams, consuming 1⅛ inches of tin and covering $228^{17}/_{32}$ square inches when edged 1 and 1¼ inches and giving a finished seam ¾ inch high, and covering $222^3/_{32}$ square inches when edged 1¼ and 1½ inches and giving a finished seam 1 inch high, with 14 x 20 tin. With 20 x 28 tin edged in the same way with a ¾-inch finished seam $477^1/_{32}$ square inches are covered, and with a 1-inch finished seam $463^{19}/_{32}$ square inches are covered.

Standing Seam, Double Lock.

This table is calculated on the basis of the amount of tin consumed by double lock machines, which is $1^7/_{16}$ inches by measurement for cross seams and covering $222^{63}/_{64}$ square inches when edged 1 and 1¼ inches and giving a finished seam ¾ inch high, and covering $216\ ^{45}/_{64}$ square inches when edged 1¼ and 1½ inches, giving a finished seam 1 inch high, with 14 x 20 tin. With 20 x 28 tin edged in the same way with a ¾-inch finished seam $471^{31}/_{64}$ square inches are covered, and with a 1-inch finished seam $458^{13}/_{64}$ square inches are covered.

DIRECTIONS FOR USE.

Look for the number of squares nearest the required surface. Note the quantity of tin opposite in the column for the kind of roof to be put on, whether it be **1-4 inch or 3-8 inch Flat Seam or 3-4 inch or 1 inch Standing Seam, Single Lock or Double Lock,** and set down the amount. Then, in the same manner, determine the quantity of tin for the odd feet and add this to the former amount. Reduce the sheets to boxes by dividing by 112.

Flat Seam Example.

How much 14 x 20 tin edged ¼ inch covering 13 x 19 will be required to cover a roof 4,665 square feet **Flat Seam?**

First look for 4,600 square feet (= 46 squares) and set down the quantity opposite, thus

	23 boxes	107 sheets
Then for 65 square feet and set down......		38 sheets
Making a total of......................	23 boxes	145 sheets

which is equal to 24 boxes 33 sheets.

Single Lock Standing Seam Example.

How much 14 x 20 tin will be required to cover a roof of 3,752 square feet with single lock cross seams and 1-inch standing seams?

First look for 3,700 square feet (= 37 squares) and set down the quantity opposite, thus:

	21 boxes	48 sheets
Then for 52 square feet and set down......		34 sheets
Making a total of......................	21 boxes	82 sheets

Double Lock Standing Seam Example.

How much 20 x 28 tin will be required to cover a roof of 2,987

square feet with double lock cross seams and ¾-inch standing seams:

First look for 2,900 square feet (= 29 squares) and set down the quantity opposite, thus:

	7 boxes	102 sheets
Then look for 87 square feet and set down...		27 sheets
Making a total of........................	7 boxes	129 sheets

Dividing 129 by 112, they are found to be equal to 1 box and 17 sheets, which added to 7 boxes

Give a total of............................	8 boxes	17 sheets

COUNTRY CORNICE SHOP.

Equipment.

How many country tinners are often called upon to do some little job or other in the cornice line, but who lack the experience which only long service in this particular branch can give. A tinner who was competent might receive such orders as putting up eave troughs that run around the corner of a building, for which miter patterns would be required, or he may be called upon to put up a sheet metal hood over a cottage entrance, for which other patterns would be required.

It has often been the case in the writer's experience that carpenters would prefer to have old wooden crosses on spires or elsewhere replaced by those of sheet metal, such as copper, zinc or galvanized iron, owing to the tendency to decay when made of wood. The writer has also seen wooden church spires, the miters of the different moldings having been drawn apart from the heat of the sun, which had to be covered with sheet metal so as to obtain a water tight job. Such cases are more than likely to arise in any country place, and the tinner or sheet metal worker would be called upon to do the work. Another job that may turn up is where a sheet metal sign is required, the letters or figures having perhaps beveled corners; or a lantern is needed having the letters or figures cut out of the sheet metal and colored glass fastened on the inside for effect when lighted at night. I remember a country tinner for whom I cut two sets of patterns for tombstones, which he informed me he would make of No. 22 gauge galvanized iron or 16 ounce copper, the copper having the preference on account of lasting the longest. I merely mention this because a country tinner might receive such an order for sheet metal work if it was known he could do it, this class of work being often made of wood in the country towns. Let the tinner become known for doing small jobs of cornice work and, providing what is worth doing is worth doing right, one job will bring another.

In some of the country towns, growing in population, brick

buildings are put up for which galvanized sheet metal cornice work is required, such as molded gutters and cornices, plain crown molds, plain dentil cornices, modillion cornices, cornices with brackets, sills and window caps, door hoods, etc. Garden vases could be constructed with wooden frames on the inside, for plants. Baptismal basins, when not made in marble, are sometimes made from heavy sheet zinc, the outside being painted to represent marble or granite. Or let us suppose that a flag pole is to be put up on a conical spire, the roof of which is covered with shingles, and it is desired to have a sheet metal base covering the joint between the pole and shingles, so as to obtain a water tight job. The tinner, not having a circular molding machine, would have to hammer the metal by hand. The method of doing this work and the way to construct the cheap, home made tools required will be fully illustrated and described in the following articles on cornice work. Again, a school house being erected, the tinner might be required to furnish a square or octagon ventilator for the roof, for although not exactly cornice work, it would be required of the cornice maker.

As mentioned before, all this and many other kinds of work would occur in a country cornice shop which can be done by the tinner, providing he will take a little pains to study out the several articles which follow.

To illustrate the work resulting from accurate patterns, obtained by the geometrical rule, and those produced by the cut and try method, I will describe an incident which occurred some time ago.

Being in a tin shop on business, and waiting for the party to return whom I desired to see, I noticed one tinner having three pieces of tin pipe, each about 10 inches long and about 4 inches in diameter, from which he wished to make an offset by the cut and try method. A brick was placed upon the bench and against the wall, which I presumed was the distance the offset was to project over the brick water table on a building. He had now cut his miter on one piece of pipe and was sighting it to see if his cut was straight, and placing the pipe just cut upon the two other pieces, the miter lines were marked and cut. After tacking the offset together, it was found that one angle was too obtuse and the other

too acute, so the tacks were opened and the miters trimmed, fitted and tacked again; then, holding one side of the offset against the wall and over the brick, it was found that the center piece of pipe in the offset was trimmed too much and would not pass the brick projection. The tacks had to be opened again, another sheet of tin rolled up and a new miter cut. All this goes to show that had the tinner been able to cut patterns for elbows of any angle by the geometrical rule there would have been a saving of time, material and temper.

This series of articles on country cornice work is intended for the country tinner as well as for the mechanic and apprentice, and, while covering a variety of problems, will at first be confined to such work only as can be done with the use of the ordinary tools found in the tin shop and such other tools as can be readily made or purchased from dealers in tinners' tools.

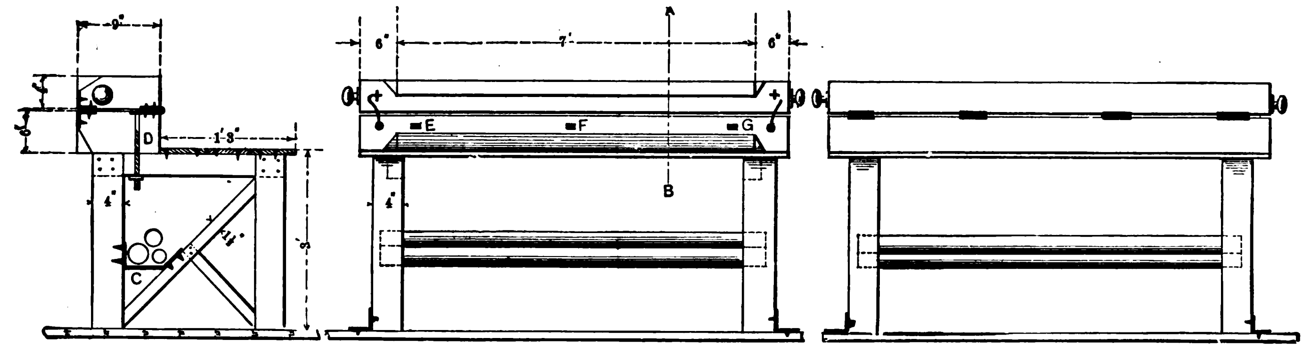
FITTING UP THE SHOP.

As the majority of country tinners have not the service of a cornice brake, one must be provided which shall be simple and inexpensive, but still turn out a fair rate of work.

The accompanying diagrams, therefore, have been prepared to explain how to construct such a brake. Let Fig. 1 represent the end, front and rear view of brake; Fig. 2 the plan. Fig. 3, which represents the enlarged section through A B, front view, also shows clamp and pipe in position, and upper leaf of brake opened, as indicated by the dotted lines.

Construct the bench for the brake as shown in the end and front view, Fig. 1, the uprights being made of 4 x 4 inch joists, braced with 1½ x 3 inch spruce strips, as shown, and which can be obtained from any carpenter. On each side of the brackets form, of 3/16 x 1¼ inch band iron a small angle, which screw to same, as shown at C, end view, Fig. 1. These form a good angle for keeping the pipes when not in use, and where they will be handy when needed. The bench should be fastened well to the floor, with angles bent of suitable band iron, as shown in Fig. 1, front and rear view.

To construct the brake obtain a piece of hard wood, from which saw a piece 6 x 9 inches by 8 feet long for the bottom and



End View. Front View. Rear View.

Fig. 1.—End, Front and Rear View of Brake for Country Cornice Shop.

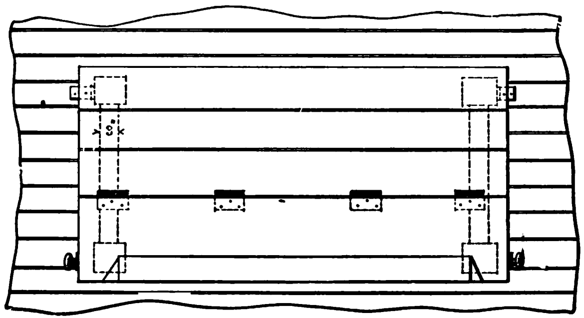


Fig. 2.—Plan View of Brake.

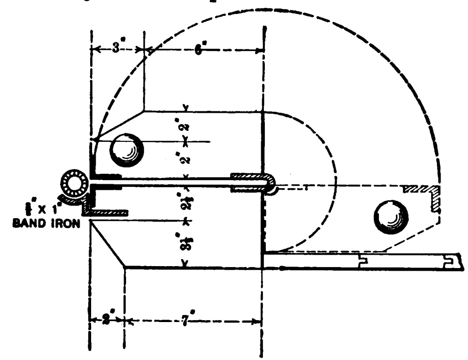


Fig. 3.—Enlarged Section through A B, Front View, Fig. 1.

a piece 4 x 9 inches by 8 feet long for the top, the corners to be beveled as shown on front and end view, Fig. 1, and in plan, Fig. 2. The inner corners of the brake are to be inlaid with angle iron of ¼ x 1¼ x 1¼ inches, as shown on end view, Fig. 1, and enlarged section, Fig. 3.

Four hinges, which can be obtained from any dealer in hardware, are to be screwed on the inside rear of brake, as indicated in the enlarged section, Fig. 3, the dotted lines showing the sweep of the brake. The position of the hinges is also shown on rear view, Fig. 1, and in Fig. 2.

After the angle iron is in place and the hinges in good working order, set the brake upon the two brackets and bolt through the wooden joists with two bolts ¾ x 12 inches, carrying nuts and washers, as shown at D, end view, Fig. 1. When the brake has been well secured obtain two large hooks and eyes from a hardware dealer, which place in position as in front view, Fig. 1. Two knobs are also to be attached, as shown in the same illustration.

Having described the construction of the brake, it will be well to briefly explain the way the iron is held, and later the use of the brake will be referred to. First grasp the knobs, and raise the top leaf until it has the position shown by dotted lines in the enlarged section, Fig. 3. The sheet or piece of iron having been placed on the lower leaf in the right position, the top leaf is raised and closed, the hooks drawn through the eyes, and we are ready to make the bend. The different ways of making the different molds and gutters will be fully explained further on. In Fig. 3 is shown one of the clamps, which should be made of ⅜ x 1 inch band iron, three being required for the brake, as indicated in the front view, Fig. 1. In cutting the holes E F and G in the lower leaf of the brake to receive the clamps, care must be taken that the clamps fit well in the openings made so as to obtain stiffness. Care must also be taken that they are cut on a line parallel with the edge of the angle iron, and that the clamps are all of one size. If the clamps are not of even size, or the holes are not cut on a horizontal line—that is, parallel to the angle iron—the bar or pipe will not rest level on the three clamps. Ordinary gas pipe can be used in 8-foot lengths, made perfectly straight. For each different mold a different size pipe will be required, and for that reason we must

have as many different size clamps as we have different size pipes. In bending the clamps care should be taken that when the pipe is placed in position half of the pipe will project over the top of bottom leaf, as shown in Fig. 3. With these directions any person should be able to construct the brake as shown.

RIDGE AND GUTTER FORMER AND BENCH TOOLS.

In making half round gutters and forming ridges, fronts of brackets and modillions, we require two stationary brackets, as shown in end and front view, Fig. 4. These brackets are to be

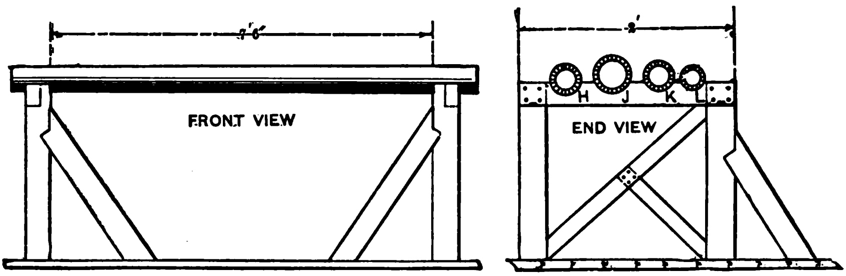


Fig. 4.—Front and End View of Ridge and Gutter Former.

constructed of the same material that was used for the brake. In forming or rolling the gutters, ridges, molds, large pipes, etc., the pipe, when laid across the top of the brackets, has a tendency to roll one way or the other according to the pressure. To obviate this we cut cross grooves on top of the joist, corresponding to the size of the pipe used, as shown by H, J, K and L in Fig. 4, end view. Fig. 5 shows the plan view of former, with pipes laid in position. The use of this former in practice will be explained as we come to the subject.

Fig. 6 is an end view of bench, showing the hatchet and mandrel stakes in position. These can be purchased from any dealer in tinners' tools, the former costing from $1 to $4, according to the length of the blade, and the latter from $3 to $8, according to the size required. The stakes are important tools for moldings of small lengths, such as finials, bases, hoods, caps, panel heads,

letters, figures, and many other little things that might be mentioned, as will be explained at the proper time.

DRAWING INSTRUMENTS.

It is of great importance for all who wish to do cornice work to become thoroughly familiar with the use of the drawing board, T-square, triangles, and a set of drawing instruments.

The drawing board for shop use should not be smaller than

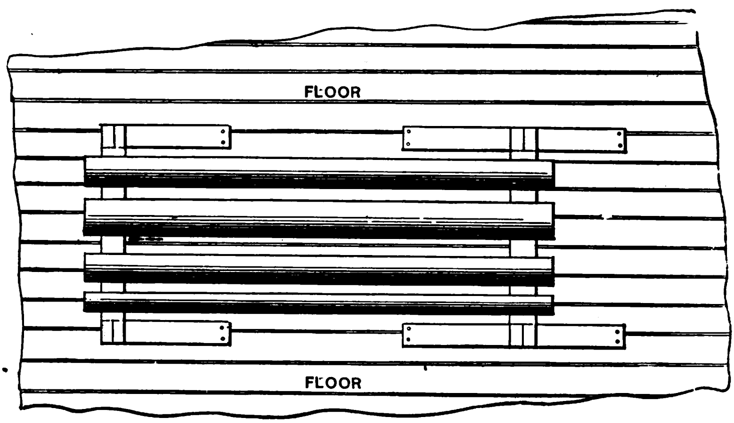


Fig. 5.—Plan View of Former, Showing Pipes in Position.

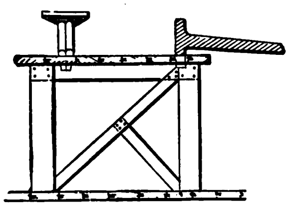


Fig. 6.—Hatchet and Mandrel Stake in Position.

about 3 feet 6 inches by 5 or 6 feet, and can be made by any carpenter. The T-square should be about 4 feet long, with a set of triangles of different angles. A brass set of drawing instruments costing from $3 to $4 will suffice. It is also convenient to have a smaller T-square on hand, say about 30 inches long, to be used for small work.

In Fig. 7 is shown a drawing board with T-square and triangle, and paper attached. When using the T-square always set it on the left side, as shown in Fig. 7, and from the bottom.

Let us suppose that we have received an inch scale drawing from the architect, from which we have to work out the detail.

To work out this inch scale drawing to full size we will require a scale with which to obtain measurements. In Fig. 8 is shown a scale, 1 inch to the foot, or, in other words, with the inches divided

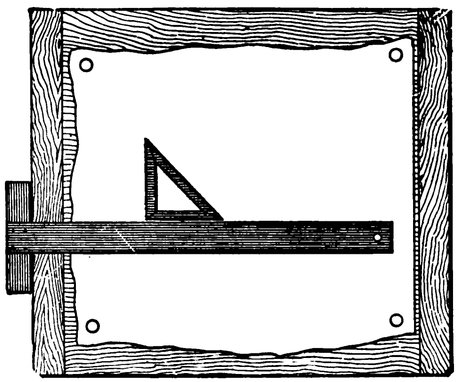


Fig. 7.—T-Square, Triangle and Drawing Board, with Paper Attached.

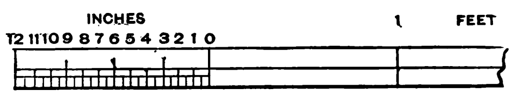


Fig. 8.—Scale of 1 Inch to the Foot.

into 12 parts. Each one of these divisions, therefore, represents a full inch on the drawing, provided it is drawn to a scale of 1 inch to the foot. The same method as shown in Fig. 8 is employed when using smaller scales. If the architect's drawings were ¼ inch scale, we would divide ¼ inch into 12 parts, and each part would represent 1 inch on the full size. Although boxwood scales with the quarter, half, three-quarter and inch scales upon them can be obtained as low as 25 cents apiece, it is better if we understand how to construct our own scales, in case none other was at hand.

Eave Troughs or Hanging Gutters.

Let Fig. 9 represent a section of hanging gutter or eave trough, with lock attached, for eaves of pitched tin roofs. These eave troughs can be made of tin, galvanized sheet iron or copper; copper, except for the cost, having the preference on account of lasting the longest and requiring no painting. The eave troughs

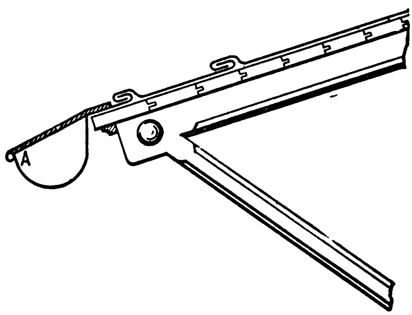


Fig. 9.—Section of Hanging Gutter with Lock Attached for Eaves of Pitched Tin Roofs.

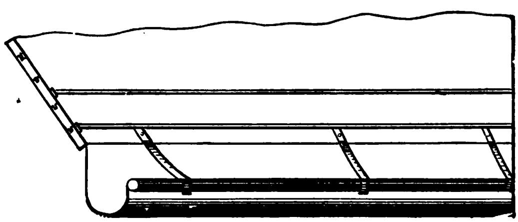


Fig. 10.—Perspective View of Gutter Shown in Fig. 9.

can be made in lengths equal to the length of the cornice brake. Care should be taken that all seams are closely riveted and soaked with solder. Should copper be used for the gutter then solder the seams on the inside only, so as to leave a clean appearance on the outside when finished. Fig. 10 is a perspective view of the same

gutter, showing the top braces in position. Fig. 12 shows the plan and side view of a wrought iron gutter brace, made of $^3/_{16}$ x 1 inch band iron. A and B are the countersunk holes for screws. If the tinner has not the service of a portable forge it is advisable to obtain one, for they are of considerable assistance for doing light iron work, the small size costing but $15. Let us suppose that the tinner has a forge, and intends to do his own wrought iron work

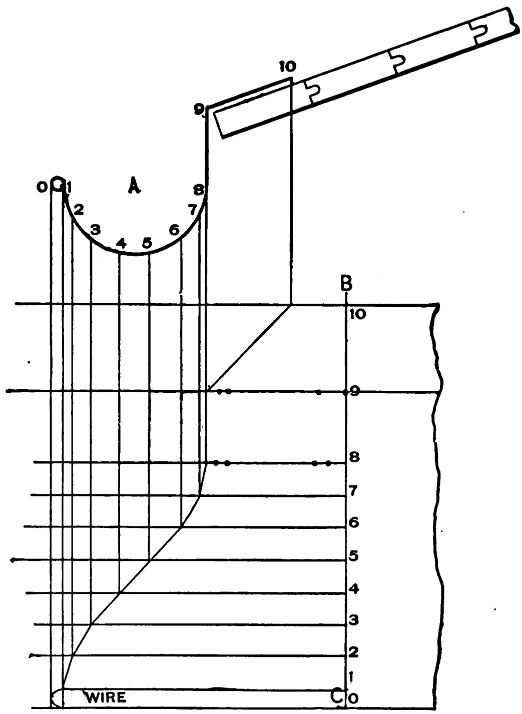


Fig. 11.—Square Miter for Hanging Gutter.

required for cornices, etc. In making the wrought iron brace shown in Fig. 12, the one end is heated in the forge almost to a white heat, and with quick successive blows with the hammer is drawn out to a point, and curved according to the size of the rod used in the edge of the gutter. As some tinners have no forge,

this work can be done by the blacksmith, or the gutter hangers may be obtained from dealers in tinners' supplies. The holes in the braces can be punched by hand and countersunk with breast

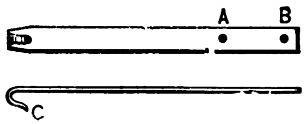


Fig. 12.—*Plan and Side View of Wrought Iron Gutter Brace.*

drills, which can be purchased from any hardware dealer. In putting up the gutter shown in Fig. 9 (the bending of which will be described later on), after having the pitch bent on it and the lock attached, take a few roofing nails or 1-inch wire nails, bend up the lock every 2 feet, and drive in a wire nail. Now replace the lock in the first position, and we are ready for the braces. The braces

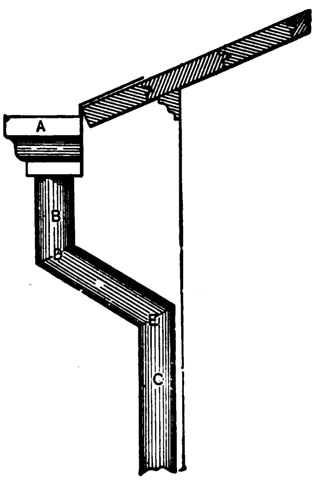


Fig. 13.—*Molded Eave Trough with Leader Attached.*

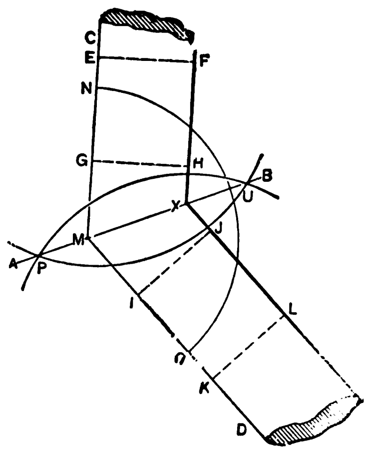


Fig. 14.—*Proving the Accuracy of the Miter Line A. B.*

should be placed about 3 to 4 feet apart, according to the size of the gutter. Take a small chisel and cut a notch underneath the wire, as shown at A, Fig. 9, and slip in the point of brace shown at

C, Fig. 12. Next drop the brace on the roof and drive the point C, Fig. 12, well around the wire A, Fig. 9, and put the two wood screws in each brace, thus completing the work of setting the gutter. The tin following is now locked in the gutter, as shown in Fig. 9.

Fig. 13 shows another form of hanging gutter or molded eave trough with leader attached. Fig. 15 gives an enlarged view of the eave trough shown in Fig. 13, also the method of obtaining the pattern for square return miter.

Let A, Fig. 15, represent the end of any molded gutter, for which we desire to obtain a square return miter head. Divide the mold A, Fig. 15, in any number of equal parts (the more parts

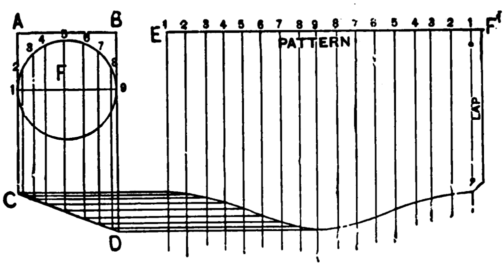


Fig. 16.—***Miter Pattern for Elbow the Angle of which is Shown in Fig.* 14.**

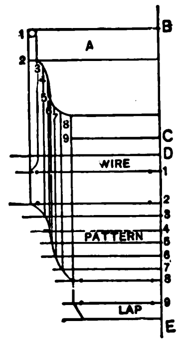


Fig. 15.—***Square Return Miter for Eave Trough Shown in Fig.* 13.**

the more accurate the pattern), as shown by the numbers 1, 2, 3, 4, etc. In line with the back of the head of the gutter, as shown by B C, Fig. 15, draw a line, as shown by D E, upon which lay off the stretchout or actual length of profile of the mold A, Fig. 15, as shown from D to E. To illustrate what is meant by the stretchout, let us take a strip of tin or zinc, say about ¼ inch wide, and bend it to the same shape as the profile of the mold A.

Now flatten out the strip and we have what is called the stretchout, corresponding to the stretchout line D E, Fig. 15. At right angles to the line D E draw lines from the small numbers, as shown, which intersect with lines drawn from the mold A of

corresponding numbers, or in other words, have the line 1 of mold A intersect the line 1 of stretchout D E, the line 2 of mold A intersect with the line 2 drawn from the stretchout D E, and so on. A line traced through these intersections will be the required pattern for a square return miter head, as shown in Fig. 13.

The method just shown is the short rule for obtaining patterns for square return miters only, or those having an angle of 90 degrees. If the angle was more or less than 90 degrees, the plan and miter line would have to be employed for obtaining the pattern, the method of which will be fully explained in the next chapter.

LEADER ELBOWS.

In making galvanized iron leaders, no lighter gauge than No. 26 should be used. If a good strong leader is required it is advisable to place the rivets about 2 inches apart, using 2-pound tinned rivets and placing washers or burrs on same; this makes a strong leader, and by using the washers the rivet heads require no soldering. The leader can also be double seamed, but I prefer a riveted leader. Copper leaders are made in the same way. When making leaders of tin it is advisable to use lead plate and groove them. Brass mounted groovers can be obtained as low as from $8 to $12. In Fig. 13 is also shown a round leader, which requires two bends to bring it plumb against the wall. As the portions of the leader marked B and C run parallel to each other, the two angles or miter joints D and E will be the same as shown in Fig. 13. Fig. 14 is an enlarged view of one of the angles of the leader shown in Fig. 13. After placing the angle or bevel which we desire the leader to have, as shown by C D, Fig. 14, and taking the width of the leader with the dividers, we lay off this diameter or width, as shown by E F and G H, at right angles to E M, and I J and K L at right angles to M D. Then draw lines through F H and L J, until they intersect at X, as shown. We now draw a line through M and X, as shown by A B, and we have what is called the miter line. To prove the accuracy of the miter line A B proceed as follows: Placing the point of the compass at M, Fig. 14, strike an arc, with which intersect the line C M and M D, as shown by the intersections N and O. Next place one leg of the

compass on the point O, and with radius greater than O M strike an arc, as shown by P U, and similarly from the point N as center strike an arc, as shown by P U, intersecting the arc struck from the center O. A line drawn through these two intersections P and U, and corresponding to the line drawn through the angles M and X, will prove the accuracy of the miter line. What we have just done is simply giving the description of the definition of the geometrical problem called "Bisecting Any Given Angle." In making any elbows or other form of molding it is only necessary to draw the correct bevel or angle and then bisect it to get the miter; or in other words, cut the angle so that when the portion of the pipe K L M X is turned over on the line M X it will correspond to E F M X, as shown in Fig. 14. We will now describe how to obtain the pattern of the elbow as required in Fig. 13. Let A, B, C and D in Fig. 16 represent E, F, M and X of Fig. 14 reversed. The miter line C D, Fig. 16, being correct, draw the profile or section of the leader, as shown at F, Fig. 16, and divide into an equal number of parts, as shown by the small numbers 1, 2, 3, 4, etc. Parallel with the lines of the pipe A C and B D drop lines until they intersect the miter line C D, as shown. Now at right angles to the lines of the pipe A C or B D draw the stretchout of the profile F, as shown by the small numbers on the line E F^1. The stretchout is the length of the circumference of the pipe stretched out straight. At right angles to the stretchout line E F^1 draw lines from the small numbers 1, 2, 3, 4, etc., which intersect with lines of corresponding numbers drawn from the miter line C D at right angles to the lines of the pipe A C or B D. A line drawn through these intersections will be the desired pattern for one portion of the elbow shown in Fig. 13.

SQUARE RETURN EAVE TROUGH MITER.

Suppose that the gutter, Figs. 9 and 10, were to return around the corner of a building the angle of which was square, or what is the same, an angle of 90 degrees, and let Fig. 11 represent an enlarged view of Fig. 9. To obtain the pattern proceed as follows: Divide the profile A into any number of equal parts, as shown by the small figures 1, 2, 3, 4, etc., from which drop vertical

lines, as shown. Parallel with the vertical lines draw the stretchout line B C of the profile A of Fig. 11, as shown by the small figures 1, 2, 3, 4, etc. At right angles to the stretchout line B C, Fig. 11, draw lines, which intersect with lines dropped from the profile A of corresponding numbers. A line traced through these intersections will be the required pattern. The small dots shown on the lines of the patterns in Figs. 11, 15 and 16 indicate the bends.

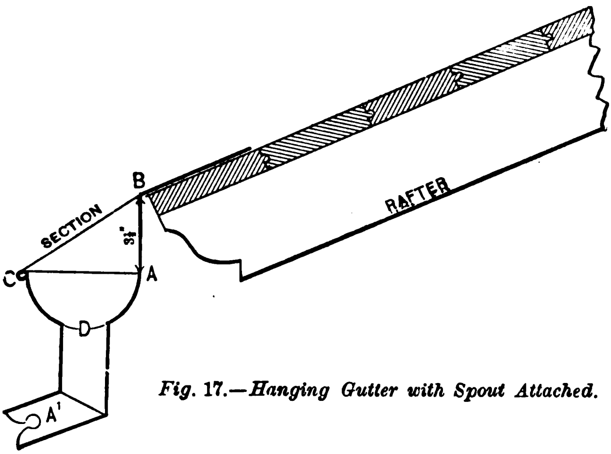


Fig. 17.—Hanging Gutter with Spout Attached.

The double dots shown on the line 8, Fig. 11, indicate where the circle stops, as shown on the profile A, space 8.

GUTTER SPOUTS.

Fig. 17 represents a hanging gutter with spout attached. These spouts can be made of tin, galvanized iron or copper. In putting up angle spouts, as shown at A', Fig. 17, it is customary to cut a scallop, as shown, so as to make a neat finish. As this is often done by hand, and hardly ever gives accurate results, Fig. 18 has been prepared showing how to obtain the pattern, for when we once have the pattern it can be saved for future use or a dozen spouts made and kept in stock to be used when required. To obtain the pattern of the scallop cut, no matter what size the pipe is, proceed as follows: Let A, Fig. 18, represent the plan of pipe and B the elevation. Care should be taken to draw the scallop in

its correct position in elevation, as shown. Divide the plan A, Fig. 18, into an equal number of parts, as shown by the small figures 1, 2, 3, 4, etc., from which drop perpendicular lines until they cut the scallop line, as shown in elevation. At right angles to the perpendicular lines or lines of the pipe draw the stretchout of the plan A, Fig. 18, as shown by C D, the small figures on the stretchout corresponding in number to those on the plan. At right angles to the stretchout line C D draw lines indefinitely from the small figures, as shown, which intersect with lines of corresponding numbers drawn at right angles to the lines of the pipe from the intersections on the scallop line, as shown. Referring to the elevation, Fig. 18, it will be seen that we have two points—namely, E and F—which we carry upward, as shown by the dotted lines, until they cut the plan, as shown by X X X X. We now transfer the extra points X X X X of plan to the stretchout, as shown.

At right angles to the stretchout line C D draw lines from X X X X, which intersect with lines drawn at right angles to the lines of the pipe from the points E and F, Fig. 18. A line traced through these intersections will be the required pattern for the scalloped mouth of spout, as shown in Fig. 17. A lap is allowed for riveting, as shown.

MAKING EAVE TROUGHS.

Now let us suppose that we have a hanging gutter or eave trough to make, 24 feet 6 inches long, the water to run from left to right standing in front of the gutter and the wire bead to be on the outside, the pitch to be 3½ inches on 24 feet 6 inches—or, in other words, the pitch to be 3½ inches from A to B, Fig. 17. Two flat heads will be required, which can be pricked from the section shown by C A D for the highest point of gutter, and B A D C for the lowest point, allowing for wire on C A for the small head and C B for the large head. There are different ways of laying out the pitch, Fig. 19 showing one method.

Strike any chalk line upon the floor or bench, as shown by A B, Fig. 19. Assuming that 7-foot sheets of iron are used, then for 24 feet 6 inches there would be required three sheets 7 feet long and one piece 3 feet 9 inches, allowing 3 inches for laps, as shown by the dotted lines C, D and E, Fig. 19. We now bead the three

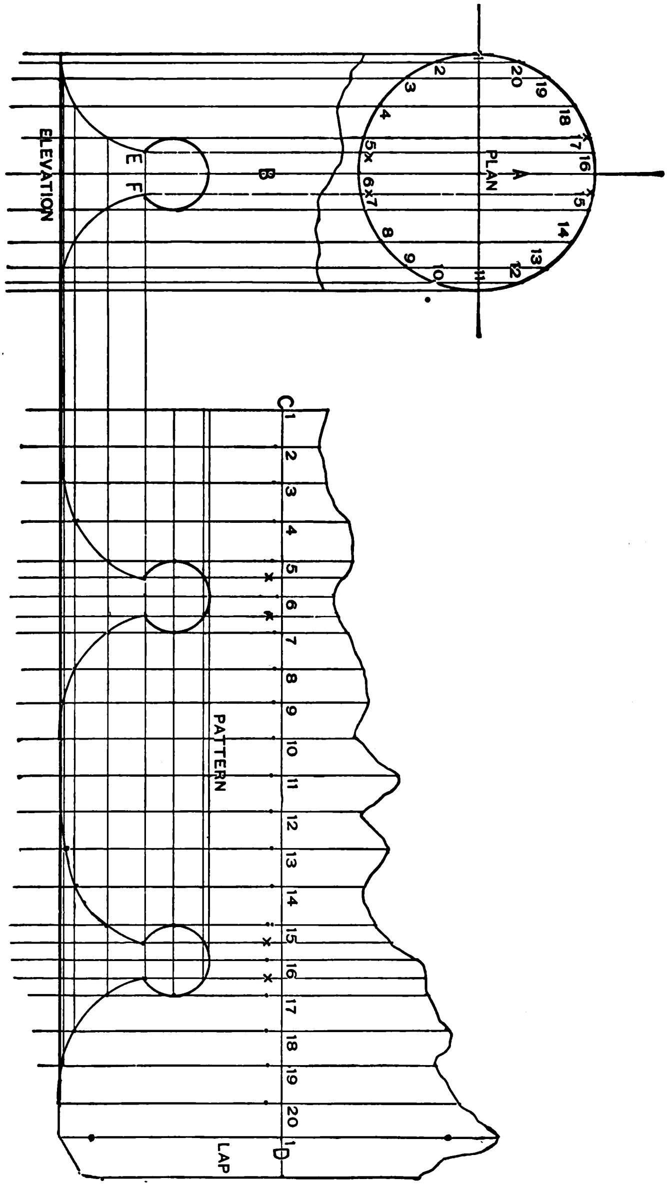


Fig. 18.—Plan, Elevation and Pattern for Mouth of Spout Shown in Fig. 17.

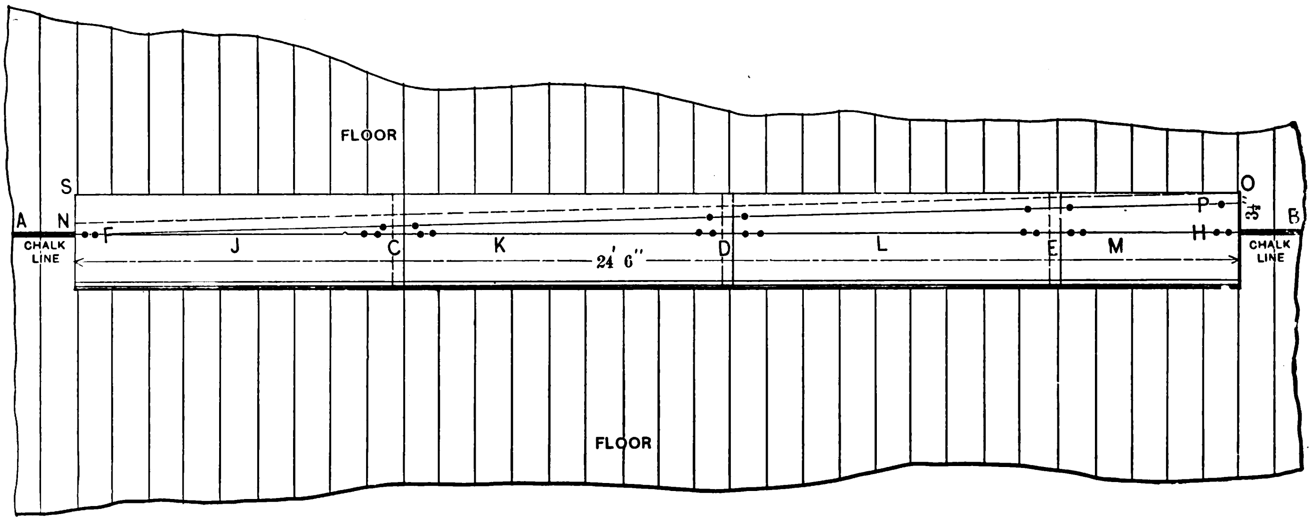


Fig. 19.—Method of Laying Out Gutter on the Floor to Obtain Pitch.

sheets and the one piece. Next get the stretchout of C D A, Fig. 17, place upon and lay it off across the beaded sheets, marking at each end of the sheet the double dots, as shown on the line F H, Fig. 19. Draw a line through each sheet on the double dots. As the water is to run to the right, we start on the right side with the piece M, placing the line drawn through the double dots upon the chalk line A B, Fig. 19. Then take the sheet L, and giving 1 inch lap, as shown at E, place the line drawn through the double dots upon the line on the piece M to the right, and on the chalk line to the left, performing the same operation with the sheets K and J. As the double dots shown at F, Fig. 19, represent the high part of gutter, the next step is to measure 3½ inches from the double dots

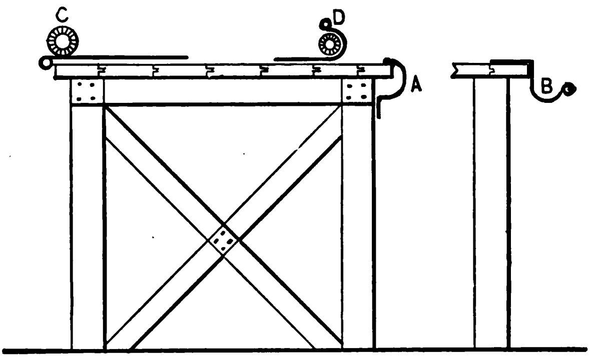


Fig. 20.—Rolling the Gutter on the Bench.

H, Fig. 19, as shown at P. Then strike a chalk line from P to F, as shown, and which will be the line on which to make the bend. If a straight line is desired on roof, strike a line as shown by N O, Fig. 19, parallel to the line P F. The portion at S O to be cut away. In striking the pitch, as shown in Fig. 19, the bead should be laid downward.

In rolling the gutter, as shown at C, Fig. 20, place the bead downward, as shown, and, taking a gas pipe or bar to suit the size of the gutter, place it on top of the sheet. Now grasp the pipe and bead, and, holding the bead firmly against the pipe, roll the pipe gradually until it has the position shown to the right at D. It is understood that the rolling shall go no further than up to the

double dots shown on the sheets in Fig. 19. In selecting the pipe to roll the gutter, it is better to take a smaller size pipe and have the gutter rolled smaller, for as soon as it is released after rolling the metal has a tendency to spring back.

Let Fig. 21 represent a section of the brake as shown before in Fig. 1. After the gutter has been rolled accurately to the profile place it in the brake, as shown by A, Fig. 21, being careful that the dots are placed at the corner of the angle iron. Close the brake, fasten the hooks, press down the gutter, taking care to keep as close as possible to the angle iron so as not to press the half-circle out of shape, then, holding the gutter firmly with the left hand against the bottom of the brake and using the mallet with the right hand, make a sharp corner, and the gutter will be in position, as shown at B, Fig. 21. In putting the gutter together strike a

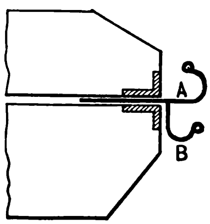


Fig. 21.

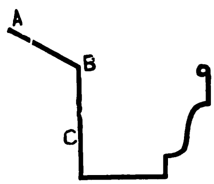


Fig. 22.—Section of Molded Gutter.

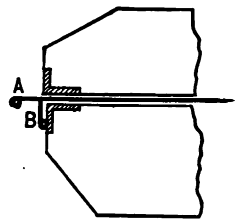


Fig. 23.

chalk line on the bench and with solder tack the bead on the line, as shown at A, Fig. 20. Then reverse it and hang it on the bench, as shown at B, Fig. 20. After the gutter is tacked with solder, rivet first and then soak seams well with solder.

OPERATING THE CORNICE BRAKE.

Let Fig. 22 represent a section of a molded gutter, which we desire to form on the cornice brake. After the sheet has been beaded and the stretchout taken of the mold, the dots are placed where the bends are to be made.

In Fig. 23 is shown the first operation. As the bead is to go on the inside of the gutter, place the bead downward, and the dot in

the right position, as shown at A, Fig. 23. Press down A and it will look as shown at B, Fig. 23, using the mallet as before explained to obtain a sharp corner.

As a right angle bend cannot be obtained on account of the bead butting against the bottom of the brake, use the gutter tongs, shown in Fig. 24, so as to obtain a right angle. These tongs are

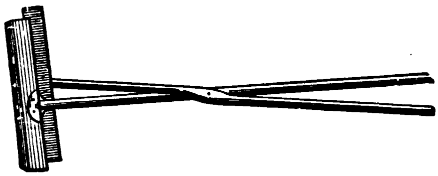


Fig. 24.—Gutter Tongs.

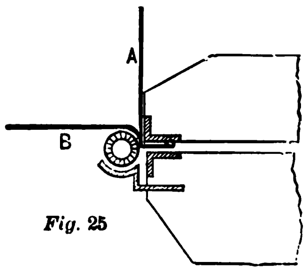


Fig. 25

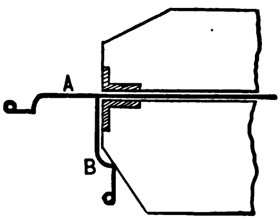


Fig. 26.

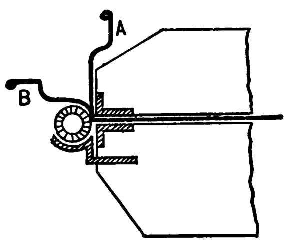


Fig. 27.

usually made of steel and cost about $3. Fig. 25 shows the second operation. Place the bead inside of brake, as shown at A, Fig. 25, being careful that the wire is placed in bead to keep it from being flattened; and having obtained the right size bar and clamp, press A over the bar and the molding will look as shown at B. Now place the sheet as shown at A, Fig. 26, and press down to the position shown at B, using a mallet to obtain a sharp corner. Next place the molding as shown at A, Fig. 27, using the clamp and bar; press down over the bar, which will give the shape B. Again place the molding as shown at A, Fig. 28, press down firmly, being careful not to flatten the molding already made, and it will look as shown at B. Place the gutter as shown at B, Fig.

29, press upward until it has the position shown at A. Finally, place the gutter in position as shown at A, Fig. 30, press downward to the angle A B C, Fig. 22, and the gutter will look as shown at B, Fig. 30, corresponding to Fig. 22, the shape desired.

In bending different shapes of moldings it is advisable to take a strip of iron about 1 inch wide, bending it to the shape required, so as to find out which way the molding forms best.

PATTERN OF MOLDED EAVE TROUGH.

In Fig. 31 is shown the plan, elevation and pattern of molded gutter or eave trough at other than a right angle, where it miters

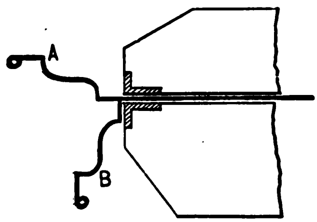


Fig. 28.

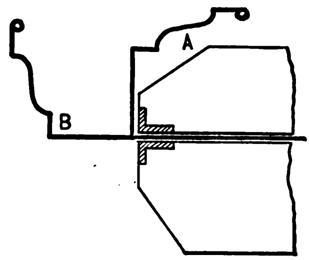


Fig. 29.

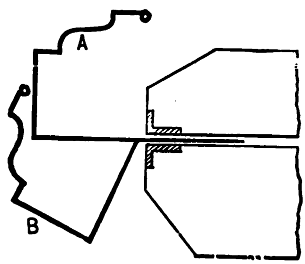


Fig. 30.

around a bay window, for example. To obtain the pattern proceed as follows: Let A, Fig. 31, represent the elevation, B C F G part of the plan. Divide the profile A into a number of equal parts, as shown by the small figures 1, 2, 3, 4, etc., from which drop perpendicular lines until they cut the miter line D E. At right angles to B D lay off the stretchout of the profile A, as shown by the small figures on H J. At right angles to the stretchout J H drop

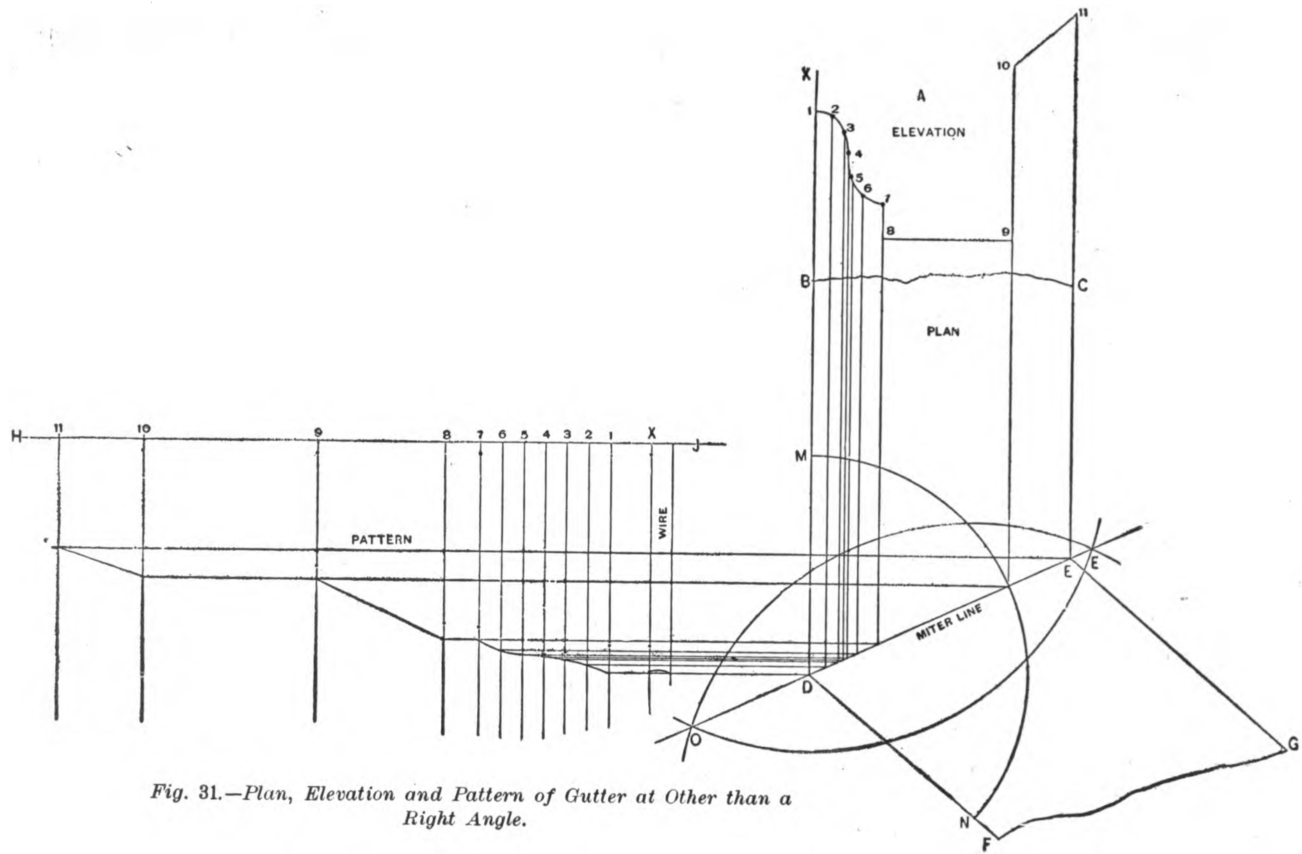


Fig. 31.—Plan, Elevation and Pattern of Gutter at Other than a Right Angle.

lines indefinitely from the points on the stretchout, as shown, which intersect with lines of corresponding numbers drawn at right angles to B D from the miter line D E. A line traced through these intersections will be the required pattern for a miter at other than a right angle. It will be noticed that we have not proven the accuracy of the miter line shown in plan view, Fig. 31. To do so set the point of the compass at D and strike an arc which will intersect the line B D and D F at M and N. Then from the point N strike an arc, as shown, from O to E, and from the point

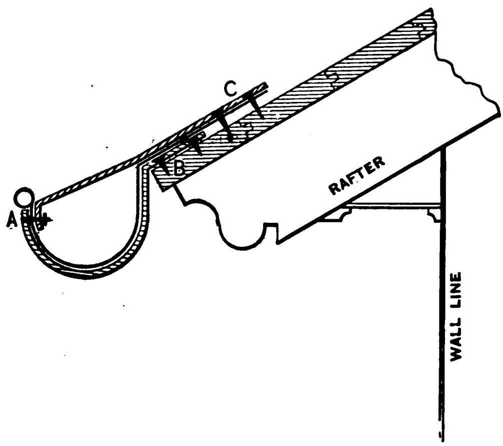


Fig. 32.—Another Form of Hanging Gutter, with Top and Bottom Brace Bolted at A.

M as center strike an arc intersecting the arc struck from the center N, as shown by O and E. Draw a line through the intersections O and E, which must correspond to the miter line drawn through the angle D and E, thus proving the accuracy of the miter line.

EAVE OR SNOW GUARD GUTTERS.

Fig. 32 is another form of hanging gutter for eaves with top and bottom braces bolted at A, as shown on diagram. This form of gutter is recommended on any steep roof which is not provided with the patent snow guards now upon the market. When the thaw sets in after a heavy snow storm the snow will slide from a

steep roof, often causing accidents. To prevent this there is shown in Fig. 32 a top and bottom brace, made of $^3/_{16}$ x 1 inch band iron, screwed to the eaves of the roofs with two wood screws through each brace. Between these braces the gutter is placed as shown, and a ¼ x ¾ inch bolt is passed through the bottom brace, the galvanized iron gutter and top brace, thus forming a solid joint at A. In practice, the bottom braces are divided as desired, and first screwed to the roof boards, as shown at B, Fig. 32. The gutter is now pressed firmly into the bottom braces and a hole punched through it at A and bolted to the upper brace. Two wood screws are screwed through the upper brace into the roof boards, as shown at C, Fig. 32. The method of forming this style of gutter was explained in Chapter III.

In bending the top and bottom braces proceed as follows: Measure off the length of the brace required, which can be done by taking a strip of tin and laying it around the outside of the gutter, as shown in Fig. 32. Cut off as many pieces of band iron to the required length as there are braces required. In forming the bottom braces roll them through the stove pipe former or roller until they have the required circle, after which place the brace in a vise and bend off the flange to the required angle, as shown at B, Fig. 32. One-quarter inch holes are now punched by hand or machine at A and B, so as to admit the bolts and wood screws. The top braces are made in the same manner and ¼-inch holes punched in them at A and C for bolts and wood screws. When this gutter is completely finished it will sustain quite a pressure. The snow sliding from the roof obtains quite a hold in the gutter and the braces prevent the gutter from breaking down.

SLATING IN ROOF OR SNOW GUARD GUTTERS.

In Fig. 33 is shown a section of a roof or snow guard gutter, also the method of slating it. To give a better explanation of this diagram the method of starting a slate roof will be explained. As this is a little out of the line of cornice work, it is better if we understand it in case the slate roofer would desire to know how many courses he should slate before the gutter is put on. Before starting a slate roof the roofer should see that a cant strip is nailed

about 1 or 2 inches above the eave line of slate, as shown at F, Fig. 33. This strip should be about ¼ inch in thickness and 1½ inches wide, the ordinary plaster laths being satisfactory. If the slates used are 8 x 16 inches in size, the first course should be laid the 16-inch way, or, in other words, the length of the slate should be laid parallel to the eave line of the roof. The second course and

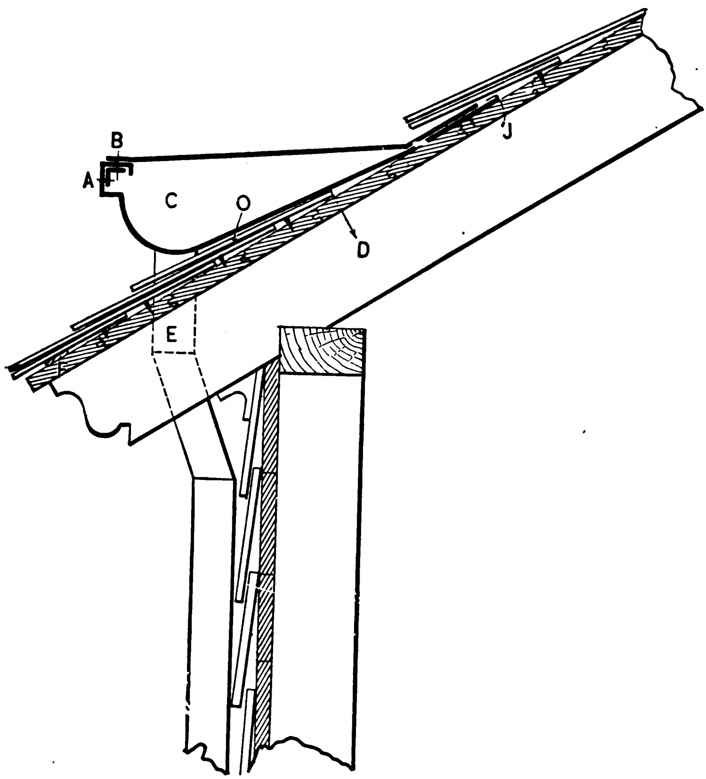


Fig. 33.—Section of Snow Guard Gutter, Showing Method of Slating.

all others should be laid the 8-inch way. In laying the 8 x 16 inch slates it is usual to lay them 6 inches to the weather, by which is meant the second course will overlap the first 10 inches and the third course will overlap the first 4 inches. Let E, in Fig. 33, represent the leader, which we desire to place in the position as

shown. The place of the leader being decided upon at once gives the position where the lowest point of gutter will be placed and the number of courses of slates required. Referring to Fig. 33, it will be seen that the slater must put on four courses of slate, counting the course under eaves (if the leader was placed higher or lower the number of courses of slates would be more or less, respectively). After the lower four courses of slates are in place the slater must stop until the gutters are set. It is usual to give about 4 inches pitch to about 20 to 25 feet of gutter.

The style of gutter shown in Fig. 33 has an angle iron of 1/4 x 1 1/4 x 1 1/4 inch in size and lighter, bolted through the galvanized iron gutter and top brace. The top braces are usually bolted about 30 inches from centers, and are made of 3/16 or 1/4 x 1 1/4 inch or 1-inch band iron respectively, and are galvanized after being made.

In putting up this form of gutter the angle iron is left out until the gutter has been placed in its proper position on roof and tacked with a few roofing nails, as shown by A and B, Fig. 36. After the gutter is set to the right pitch the angle iron is pressed up into the inside top edge of the gutter and held in position with a few hand vises, as shown in Fig. 34, until the bolts are inserted, after which the hand vises are removed. If a punching machine is not at hand, the holes in the angle iron and the top braces can be punched by hand by having a female die placed on a solid block of iron or wood, so that when the punch is being driven from the top there will be no springing.

The holes in the top braces to receive the wood screws can be countersunk by means of a breast drill if a machine is not at hand. The breast drills, including the punches and dies, can be purchased of any dealer in tinners' and cornice makers' tools. After the top braces are bolted to the angle iron at B, Fig. 33, a wood screw or two is screwed through the top brace at J. The slate roof is then started again, in the same manner as described for the eaves. The method for forming the gutter shown in Fig. 33 is the same as described in Chapter III.

ROOF COVERING OTHER THAN SLATE.

If the roof covering, as shown in Fig. 33, were to be of shingles the same rule would be followed as for slate. If tin were

used, then tin up the roof as far as shown at D, Fig. 33, and set the gutter in its right position. As the gutter is to set to a given pitch, the upper edge of the gutter J, Fig. 33, would be cut on a straight line, struck by means of a chalk line and chalk, and then a lock attached, as shown at J K, Fig. 40. The tin is now locked on to the flange of gutter and the roof tinned up.

If the roof were of corrugated iron, the sheets would be allowed

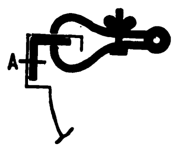


Fig. 34.—Angle Iron Held in Position with Hand Vise.

Fig. 35.—Lap on Corrugated Iron Roof.

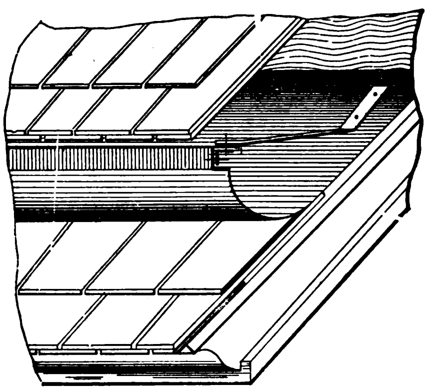


Fig. 36.—Perspective View of Roof or Snow Guard Gutter, Showing Angle Iron and Brace.

to extend up as far as D, Fig. 33, and cut off square, by means of corrugated shears, which may be obtained from any dealer in tinners' tools. The gutter would now be set to the proper pitch, on the top flange of which a lock would be made, as before described, it not being necessary in this case to cut the flange straight. This lock would prevent the snow from driving up under the corrugations. In laying a corrugated iron roof as much lap should be

given as is shown in Fig. 35. In tile roofing the same method would be employed as described for slating.

It is very advisable, if the roof covering is of slate, tile or shingles, to lay a sheet rubber cushion, not less than $^3/_{16}$ inch in thickness, between the bottom of the gutter and top of the slate, tile or shingle, as shown at O, Fig. 33, to prevent breakage in case a large amount of snow would slide into the gutter. The rubber should be as wide as the part of the galvanized iron flange of gutter that lies against the slate.

Fig. 36 is a perspective view of roof or snow guard gutter, showing the slates in position above and below the gutter, also the

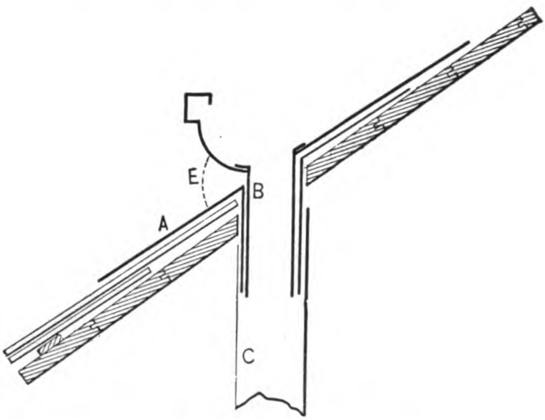


Fig. 37.—Proper Method of Making Water Tight Joint with Sleeve, Tube and Leader.

angle iron and brace bolted in position, and top brace screwed on the roof board, through the gutter flange.

CONNECTING GUTTER TO LEADER.

Let us assume that the gutter is to be connected to a round leader. In Fig. 37 is shown the method of obtaining a water tight joint on roof, with the use of sleeve, tube and leader, and in Fig. 38 the improper method of making a joint, with the use of the tube and the leader only. It is of great importance that this method of putting in the sleeve be understood, as by not using the sleeve a leak is often the result. In Fig. 37, let A represent the

sleeve, B the tube and C the leader. It will be noticed that both the sleeve and tube go inside the leader, so that in case the snow drives against the angle E and thaws it must drip inside of the leader; while, as shown in Fig. 38, the snow driving against the

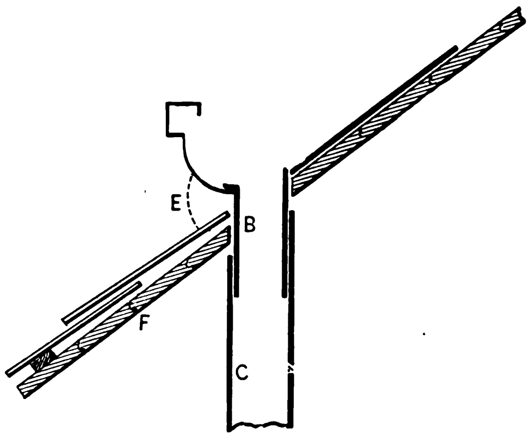


Fig. 38.—Improper Method of Making a Joint.

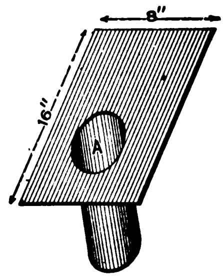


Fig. 39.—Metal Shingle with Sleeve Attached.

angle E when thawing, soaks through the wood work F and rots it at every storm, because the tube B only connects to the leader C. In Fig. 39 is shown a perspective view of a metal shingle having sleeve attached. These shingles are to be cut to the size of the slates used, in this case 8 x 16 inches, and laid in with the

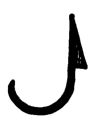


Fig. 41.—Wrought Iron Hook Leader.

course, where the roofs are covered with slate, tile or shingle. The sleeve shown at A, Fig. 39, should be soldered to the shingle where required; that is, just according to how the leader would be situated. In case the leader is so situated as to strike the bot-

tom, center or upper part of slate, the sleeve A would have to be placed accordingly.

At P, in Fig. 40, is shown a shingle with sleeve attached, slated in as required, the leader having in this case cut the shingle in the center. The tube of the gutter passing through the sleeve connects to the leader below at F. In fastening the leader F the ordi-

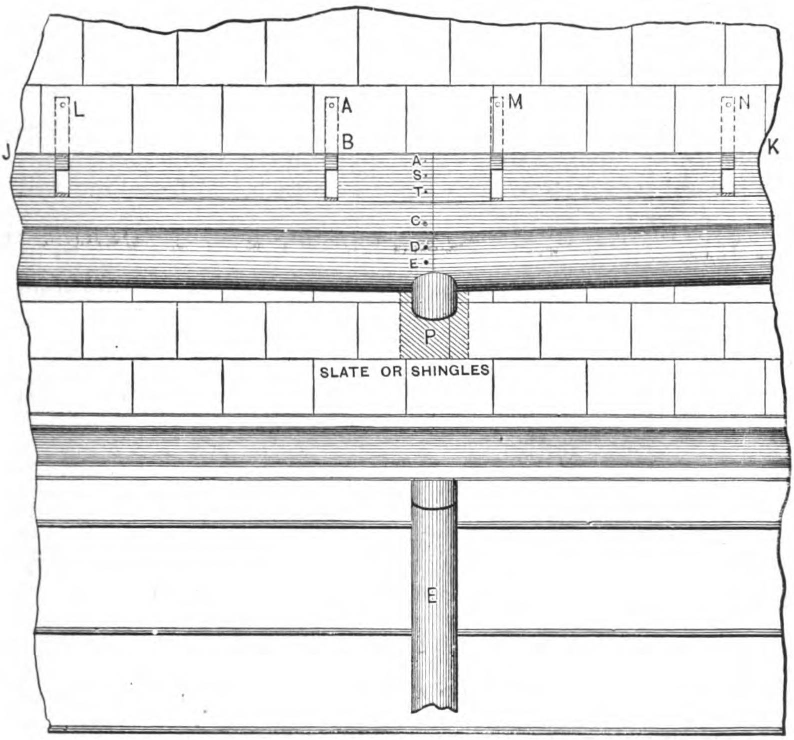


Fig. 40.—Front View of Roof or Snow Guard Gutter.

nary hooks are used, as shown in Fig. 41, which can be made by any blacksmith or purchased of dealers in tinners' supplies. There are different forms of leader hooks and fastenings with ornamental coverings, which will be fully explained and illustrated in another chapter.

In Fig. 40 is shown part of a front view of a roof or snow

guard gutter, finished complete, the section of which is shown in Fig. 33. L, A, M and N represent the rubber cushion, not less than $^3/_{16}$ inch in thickness, between the bottom of the gutter and top of the slate, tile or shingle, as shown at O, Fig. 33, to prevent breakage of gutter, and R, S and T the tinned or brass wood screws screwed into the roof boards through the flange of galvanized iron and soaked well with solder.

OBTAINING WORKING MEASUREMENTS.

Having understood how the snow guard gutter is to be constructed, the measurement and bevel of roof must now be obtained from the building. Brass and wooden bevels can be purchased from hardware dealers, but a bevel constructed of band iron will answer just as well.

In Fig. 42 is shown what is required to construct a bevel of band iron. Let A represent one of the two pieces of band iron,

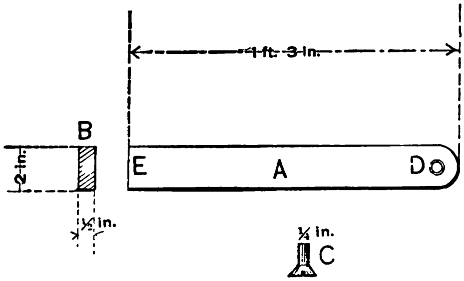


Fig. 42.—Rivet and Band Iron for Bevel.

with a ¼-inch hole punched and countersunk, as shown at D, to receive the rivet, and B the section. C represents a ¼ x ⅝-inch rivet, which is used to rivet the two pieces of band iron together. Care should be taken that when the two arms are riveted together the one is exactly like the other and that the end E is perfectly square.

When the bevel is finished and is in use it will look as shown at L, in Fig. 44. Fig. 43 is the front elevation of roof and gutter, also showing the method of obtaining the working measurements.

Let the width of the building on which the gutter is required

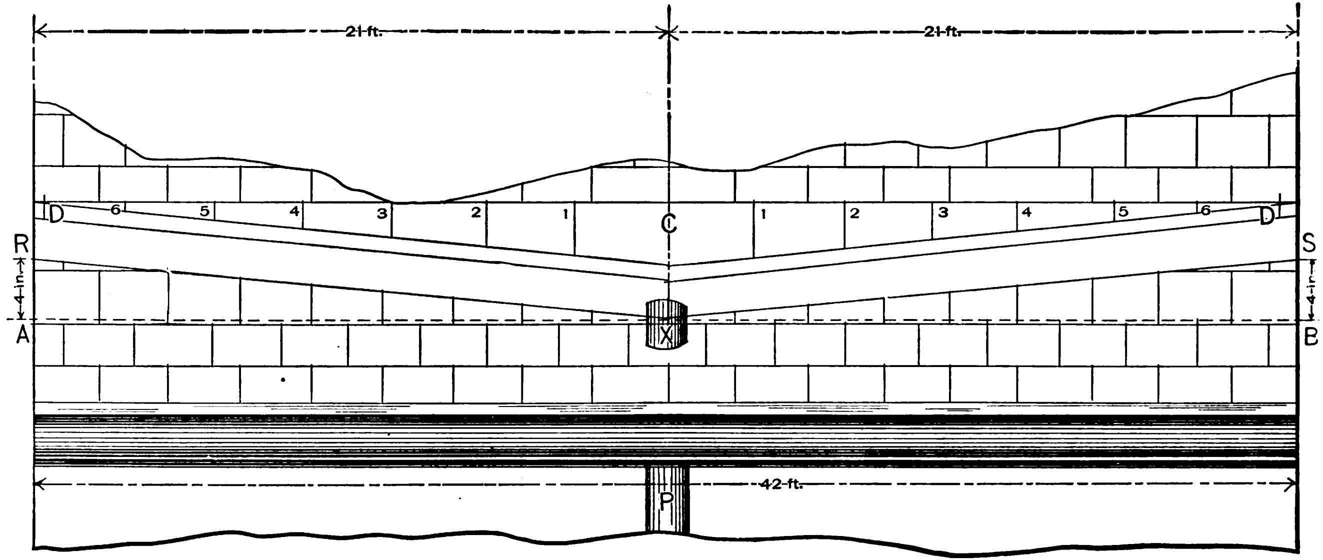


Fig. 43.—Front Elevation of Roof and Gutter.

measure 42 feet, as shown, and as the leader P is to be in the center of the building, divide the width by 2, and 21 feet on each side is the result, as shown. The pitch, or fall of the gutter, will come directly over the leader, as shown by X, Fig. 43.

From the point X, Fig. 43, or the lowest point of gutter, strike a chalk line parallel to the eave line, as shown by the dotted line A B. At right angles to the line A B, on either side, measure up 4 inches, or the pitch of the gutter, on a perpendicular line, as shown by R and S, Fig. 43. Now strike a chalk line, S X and X R, which gives the bottom line of the gutter, shown on the section in Fig. 44 at O. The line R X and X S would be struck on top of the slates, or whatever the covering of the roof may be, and upon this line the bottom line of the gutter would be placed.

Having now obtained the length of each side of the gutter, the next step is to obtain the level of the roof. To do so, place the bevel as shown by U V Y in Fig. 44, the arm U V being placed against the roof and the other arm, V Y, being raised or lowered until level, which can be proven by screwing a small spirit level on the arm, as shown at J. Now measure the distance between the arrow points K, and the bevel can be closed and opened again when required to the distance before obtained. This bevel forms the basis of measurements required to construct the different braces shown in Fig. 44.

In setting up work of this kind it is well to make a rough diagram, similar to Fig. 43, showing the braces required and their numbers, also the pitch the gutter is to have, for the use of the mechanic who sets up the work. As the braces are of different lengths (to obtain a straight line, as shown from D to D in Fig. 43), each brace will be numbered in the shop to correspond to the numbers shown on the braces in Fig. 43 by C, 1, 2, 3, 4, etc.

OBTAINING THE DIFFERENT LENGTHS OF BRACES.

In Fig. 44 is shown the method of obtaining the different lengths and angles of braces. Draw any horizontal line, as shown by S T, indefinitely, upon which place one arm of the bevel Y V; now open the bevel to the length obtained between the arrow points K, as before explained, and draw a line parallel to, and

against the arm of the bevel U V, as shown at X′ S′. Then X′ S′ will represent the roof line and S T the horizontal or level line, corresponding to the bevel U V Y. Now draw a section of the

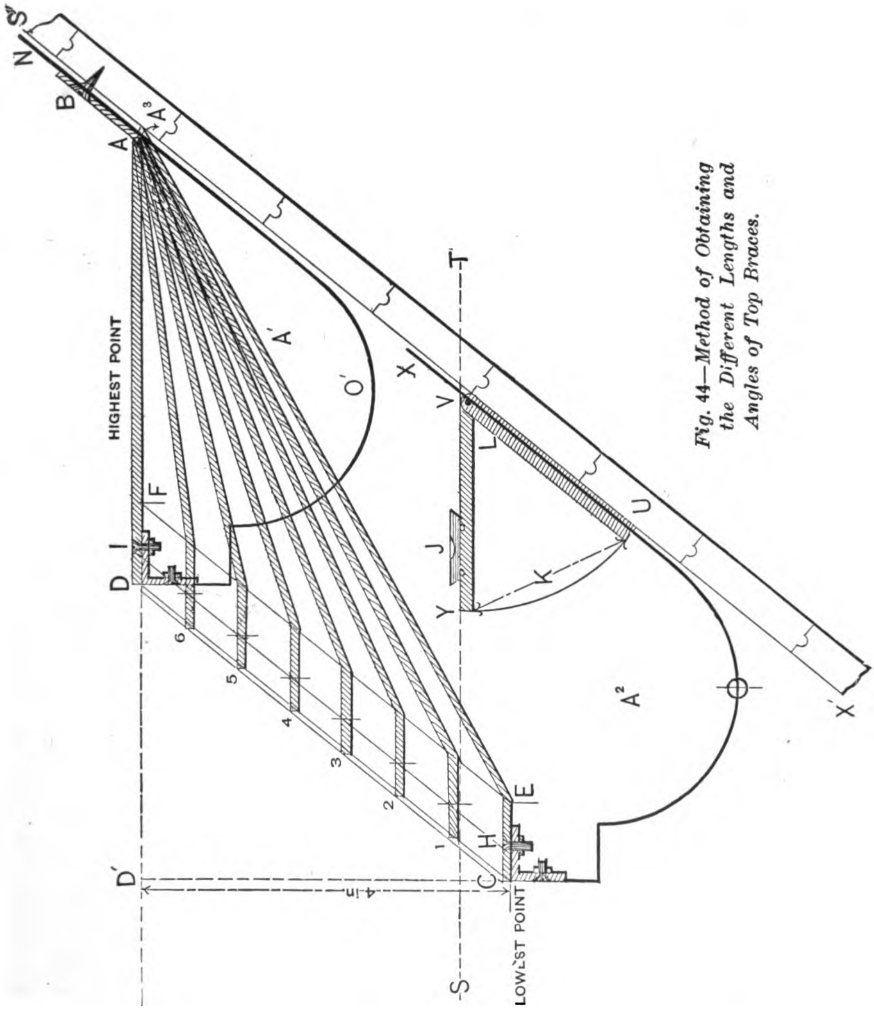


Fig. 44—Method of Obtaining the Different Lengths and Angles of Top Braces.

gutter, as shown by A′, Fig. 44, care being taken to have the top of the flange of the gutter, as shown at N, high enough above the top of the front of the gutter, so that in case the leader stops up,

causing an overflow, the water will flow over the front of the gutter, and not behind the flange N and into the building.

As the pitch of the gutter is 4 inches on a perpendicular line, as shown in Fig. 43, measure down 4 inches from D′ to C, Fig. 44, and draw a duplicate of the section of the gutter A′, as shown by A^2. Then D will represent the highest point of gutter and C the lowest point, as shown. The sections of angle iron, with bolts through the top braces, are shown at I and H. Draw the brace at the highest point of gutter horizontal, as shown from D to A, with an angle attached to screw to the roof board, as shown from A to B. Then draw the brace for the lowest point of gutter horizontal from C to E, or as much as there is flange on the top of the gutter. Connect the points from E to A^3 and add the thickness of the brace, as shown, which in this case is $^3/_{16}$ inch.

Then D A B, Fig. 44, will represent the top brace D, Fig. 43, and C E A^3 B the center or bottom brace C, shown in Fig. 43. As the pitch of the gutter is 4 inches and the projection of the roof on 4 inches as much as shown from D to D′, Fig. 44, and as there are eight braces required on the 21 feet of gutter, as shown by C, 1, 2, 3, 4, 5, 6 and D in Fig. 43, it is self evident that each brace will be of a different length and angle.

To obtain the different lengths and angles proceed as follows: Draw a line from C to D, Fig. 44, as shown, and divide this line into seven spaces, or as many spaces as there are shown between the braces in Fig. 43. Now draw a line from E to F, which intersect with horizontal lines drawn from the small figures on the line C D. From the intersections obtained on the line E F draw lines to the corner A. Now add the thickness of the brace, as shown, and draw lines parallel to the horizontal lines 1, 2, 3, 4, 5 and 6, intersecting the line E F, and from these intersections draw lines to the corner A^3. Then the braces C, 1, 2, 3, 4, 5, 6 and D in Fig. 44 will represent the braces used on each side of the gutter of corresponding figures shown in Fig. 43. A line drawn from H to I, Fig. 44, will give the points where the holes are to be punched for the bolts; the angle A B will be the same length on all the braces.

After the braces are bent to the required angle and numbered, they are usually galvanized to prevent rusting; the angle iron also

is usually covered with two coats of metallic paint before it is inserted in the gutter.

Fig. 45 is a section of a roof or snow guard gutter, the bends of which have been made square, so as to avoid a confusion of lines in obtaining the patterns; although the principles used are the same no matter what form or shape is taken. To obtain the plan and elevation proceed as follows: Let N S, Fig. 45, represent the line of roof; C, the highest section of gutter, and D the lowest section. Let A B or H F represent the pitch of the gutter on a perpendicular line and E F the projection of same. Let R S U T, Fig. 46, represent one-half of the plan of the roof, the width of same being 21 feet. Now draw any line parallel to the eave line of roof, or T U, as shown by V W; take the distance of the projection of the gutter, shown by E F in Fig. 45, and place same at right angles to V W, as shown by V X, Fig. 46. Now draw a line from X to W, as shown. At right angles to the line X W place in the proper position, as shown at A, a duplicate of the profile or section of gutter shown at C or D, Fig. 45. Number the bends of the profile A, Fig. 46, as shown by the small figures 1, 2, 3, 4, 5, H and 6. Now parallel to the line X W draw lines through the numbered bends, cutting the lines R T and S U, as shown. Parallel to the line X W draw a line indefinitely, as shown by X′ W′. At right angles to the line B D in plan draw lines upward from B and D indefinitely, as shown by B C and D E, cutting the line X′ W′ at the points J and E. Now take the pitch of the gutter, as shown by A B or H F, Fig. 45, and transfer this hight from the point J on the line B C, Fig. 46, as shown by J F, and draw a line from F to E. Then F E will represent the line of the gutter in the true elevation on the point 6 in the profile A in plain view. Now place a duplicate of the profile or section C, Fig. 45, or profile A in plan view, Fig. 46, as shown by A′ in true elevation, the small figures 1′, 2′, 3′, etc., of profile A′, corresponding to the small figures shown in plan view. Through the small figures 1′, 2′, 3′, etc., in profile A′ in true elevation draw lines parallel to the line F E, which intersect with lines of corresponding numbers drawn at right angles to the line X W from the intersections made on the lines R T and S U, all as shown. A line traced through these in-

tersections, as shown by L and P, will show the true elevation and miter lines of roof gutter.

To obtain the pattern, proceed as follows: At right angles to the line F E lay off the stretchout of the profile A′, Fig. 46, as shown by the small figures from Y to Z. At right angles to Y Z, or parallel to F E, draw lines indefinitely through the small figures in the stretchout, as shown, which intersect with lines drawn at right angles to the line F E from the intersections on the miter lines L and P of corresponding numbers. A line traced through the intersections thus made will be the required pattern.

To obtain the pattern for the head of the gutter shown at R

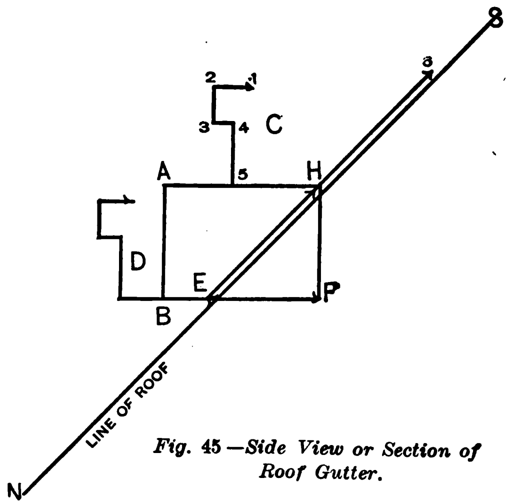


Fig. 45 —Side View or Section of Roof Gutter.

and S, Fig. 43, proceed as follows: At right angles to the line B C, Fig. 46, draw lines from the intersections on the miter line L. It will be noticed that these lines are numbered 5′, H′, 3′, 4′, 2′, 1′ and 6′, corresponding to the same numbered lines, drawn through the profile A′, in the true elevation. At right angles to where the gutter intersects the line X B, plan view, Fig. 46, draw short lines, as shown by 2, 3, 4, 5, 1, H and 6, corresponding to the same numbered lines drawn through the profile A in plan view. Now parallel to the lines drawn at right angles to B C draw a line, as shown by A′ B′, upon which place the widths, as shown by 2, 3, 4,

5, 1, H and 6, corresponding to the intersections on the line X B, plan view, as shown by 2, 4, 5, 1, H and 6. Then at right angles to A′ B′ draw lines upward from the small figures, as shown, intersecting lines of corresponding numbers drawn from the miter line L, at right angles to B C. A line traced through these inter-

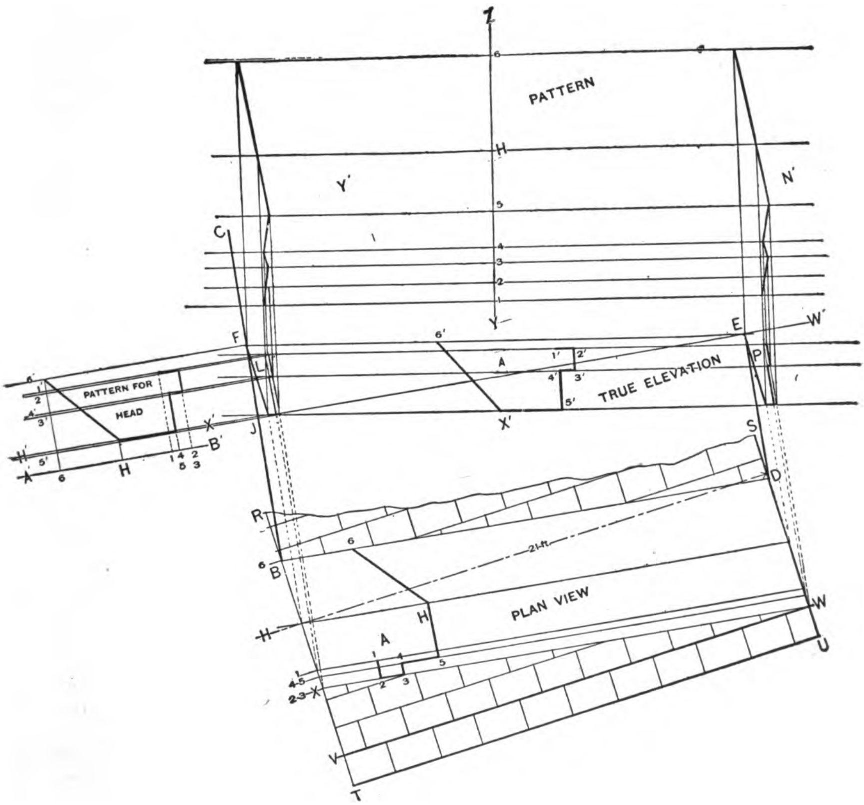


Fig. 46.—Plan View, True Elevation and Pattern of Roof Gutter.

sections will be the pattern for the head of the gutter required at R and S, Fig. 43.

To avoid any misunderstanding, it is well to remark that the sections shown at C and D, Fig. 45, do not represent the true sections on the lines R T and S U, plan view, Fig. 46, and are only drawn to form a basis from which to obtain the measurements of

the pitch and projection of the gutter, and are sections of the gutter at right angles to B D, plan view, and sections at right angles to F E, true elevation. The pattern for the head of the gutter, as shown in Fig. 46, is the true section of the gutter on the line R T and S U, in plan view.

In practice it would be impossible to lay out a drawing of 21 feet on the ordinary drawing board, although the gutter could be laid out on the floor. To avoid this and to make use of the drawing board, the entire measurements could be divided into eight parts or less, according to the length of the drawing board in use.

The following explanation is given to illustrate what is meant by dividing the measurements: By dividing the measurements into eight parts, instead of laying off 21 feet, as shown from V to W, Fig. 46, take one-eighth of same, which is 2 feet 7½ inches, and make V W equal to 2 feet 7½ inches; then, instead of making V X, Fig. 46, the projection of gutter, as shown from E to F, Fig. 45, make it one-eighth of E F. And having obtained the line X′ W′ in true elevation, Fig. 46, instead of making J F equal in hight to A B or H F, Fig. 45, make it one-eighth of the distance. By dividing the length, projection and pitch of the gutter each into the same number of equal parts, the same angles are obtained as in the full size drawing.

SHORT RULES.

It is also proper to remark in this connection that, if but one gutter was being put up, it would hardly pay to get out the patterns as above described, as the time involved in obtaining the patterns would cost almost as much as the amount a small gutter would bring. In such a case the gutter would be made a few inches longer than the desired length and placed on the roof in its proper position, and tacked with a few roofing nails. Then take a carpenter's square and place the long arm on the roof parallel with the eave line, and, holding the short arm of the square perpendicular, mark off a perpendicular line on the top and bottom ends of the gutter where required, and trim with the hand shears or snips. Then the lower cut will represent the miter line on which the second piece of gutter would be joined, and the top cut may be used to obtain the pattern for the flat head, by simply hold-

ing a piece of galvanized iron or other metal against same and marking off the shape.

It is, however, a good plan to obtain accurate patterns, as described, which are saved for future use; and when a gutter of this style is required, it can be given the same shape and pitch. Thus the same pattern can be always used, it only being necessary to obtain the amount of pitch required on every gutter of a different length, so that a chalk line indicating the pitch can be struck on the roof on which the bottom line of the gutter is placed.

Now, as above described, if a gutter of 21 feet has 4 inches pitch, then a gutter of 10 feet 6 inches would have but 2 inches pitch, or in other words, the gutter would have a fall of $4/21$ inch to the foot. As $4/21$ makes the figuring complicated, ¼ inch fall to the foot could be given and the patterns cut accordingly. This would make the pitch on 21 feet equal to 5¼ inches. In case a gutter was required measuring 21 feet 5½ inches, it would be necessary to obtain the amount of pitch required for the 5½ inches in length. To obtain this without tedious figuring, construct on a piece of heavy white cardboard, for future reference, a triangle whose base is 12 inches in length (divided into half and quarter inches) and the altitude or perpendicular hight as much as the fall of the gutter is to the foot, which in this case is ¼ inch. Connect the altitude and the base by a line called the hypotenuse or slant line, which completes the triangle. From the divisions on the base of the triangle draw lines at right angles, intersecting the hypotenuse, or slant line. Then place one leg of the dividers on the 5½ inch division on the base, and the other leg of the dividers at the point where the 5½ inch perpendicular line intersects the hypotenuse; then the distance between the points of the dividers will be the amount of pitch required for the 5½ inches of gutter. This rule applies to any measurements whatever.

Molded Gutters on Brick Walls.

Fig. 47 shows the method of fastening a sheet metal molding to a brick wall, on which the gutter is formed of wood and then lined with sheet metal. A is a section of the brick wall, the upper portion, L, being built up to but half the thickness of the wall, as shown, thus leaving a space on which to build the gutter, as shown

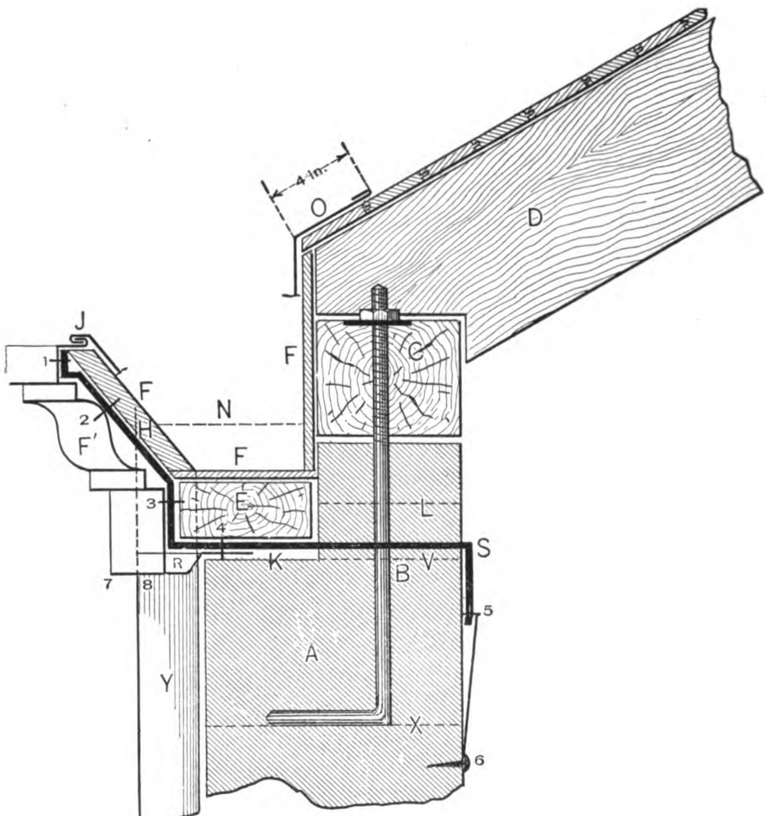


Fig. 47.—Fastening a Sheet Metal Molding to Brick Wall.

at K. C represents the wooden wall plate, fastened to the wall by means of the bolt B, which has an angle at the bottom. The bolt is placed upon the wall when up as high as shown by the dotted line X. The wall is then built up around the bolt, after which a hole is made in the wall plate C and set over the bolt and fastened with a washer and nut, as shown. D represents the rafter on which the roof is planked, and to this the flange of the gutter lining is nailed. As all this has no bearing on the cornice work, it is only briefly explained so the reader may better understand the sectional views of this kind of work. In making the details for the molding and brace, shown in Fig. 47, care should be taken that the inside brace, shown from 1 to 5, is so drawn that a portion will meet the top member of molding at 1, at part of the ogee, as shown at 2, at the flat portion, shown at 3, and on the flange of the drip, shown at 4. Bolts are then inserted through the molding and brace, as shown at 1, 2, 3 and 4. The thickness of the wall A is taken and the brace made to extend through it, allowing for a flange to bend down behind the wall, as shown at 5. The length of the flange should be less than the hight of a brick. Care should be taken in drawing the top flange and lock of the molding that the lock J, Fig. 47, comes directly over the center of the gutter plank H, so that when the sheet metal lock of the gutter lining is locked into J of the molding and pounded down with the mallet the blow will come directly over the center of the wooden plank H. If the lock J should come in further than the thickness of the gutter plank H, a bad seam would be the result, because the locks could not be driven together, there being no foundation to pound on. It will be noticed that that portion of brace in Fig. 47 which meets the ogee at 2 at once gives the shape of the gutter on the inside, against which the plank H is laid, as shown.

CONSTRUCTING AND PUTTING UP THE WORK.

After the molding is formed on the brake, and set together to the required length, the braces are inserted about 30 to 36 inches from centers, care being taken that the length of the brace from R to S, in Fig. 47, is correct so as to slip over the wall.

The mason, when building up the wall, usually has a scaffold

on the front, which is often used by the cornice maker to put up his work. One way to set moldings of this kind is to have the mason stop with his wall when he gets up as far as shown by the dotted line V, Fig. 47. The braces are put in the molding in the shop, with the flange S 5 already bent. A hole is punched through the brace, as shown at 5, in which to fasten the wire.

Now set the molding and braces upon the wall and have the drip R of the molding fit well against the face of the wall, as shown. As the molding will have a tendency to tip forward when set, fasten a piece of wire in the hole 5 of brace, press down the brace at S firmly onto the wall, and fasten the wire with an anchor nail into the joint of brick work shown at 6. The wall L is now built on top of the braces, which holds the molding in its proper position. As the full depth of the gutter down to the wall K is not required, blockings of wood are placed upon the braces, as shown at E, Fig. 47. In gutters of this kind the carpenters should prepare the pitch of the gutter. F represents the lowest point of gutter and N the highest; and after obtaining the required length of the gutter the lowest point would be blocked up with wood to the hight of F and the highest point blocked with wood as high as N. A chalk line is then stretched from N to F and intermediate blockings placed. The gutter is planked out as shown by F F F and connected with the roof boards, after which it can be lined with either tin, copper or galvanized iron, locking the lining into the front lock on molding as before explained, and leaving a flange on roof of about 4 inches, as shown at O, which would be sufficient lap, whether the roof were covered with tin, slate or shingles.

It is the writer's preference in putting up moldings of this kind to let the mason and framer first finish their work complete. When the work is put up before, by the time the mason has finished his wall and the framer has his wall plate and rafters set the molding is usually pressed out of shape and flattened.

When putting up the molding after the wall is finished, set it temporarily against the wall and mark where the braces will come, so as to cut the holes shown from L to V, Fig. 47. As before explained, the angle of brace S 5 should be less than the hight of a brick, so that the holes cut with the use of a chisel and heavy ham-

mer through the brick wall need be the hight of one brick only. The braces having been slipped through are then drawn down with wire, as before explained, and the mason closes up the holes with brick, thus holding the braces firmly in position. Y in Fig. 47 represents the leader to carry the water from the gutter. The back of the leader, laying against the wall, is carried up through the blockings, as shown by the dotted line, and intersects the gutter on the bottom line F. The front of the leader is run up through the molding and intersects the plank H at F. Now, if the leader was left in this position it would deface the entire front of the molding; so to overcome this a projection the width of the

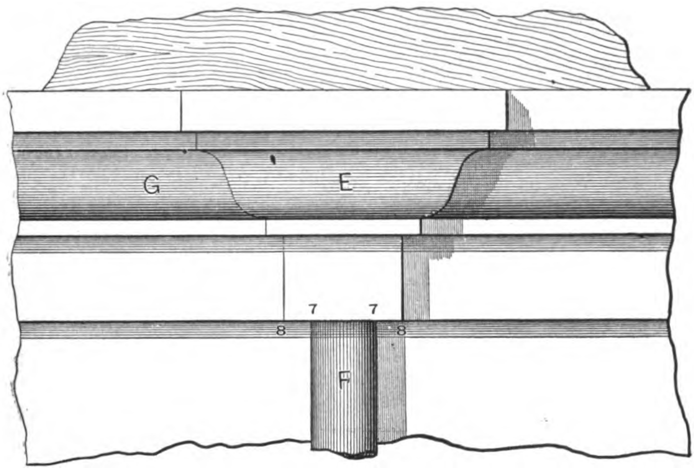


Fig. 48.—Front Elevation of Molding, Leader and Head.

leader is placed over it, as shown at F′, Fig. 47. This at once forms a leader or conductor head, the face of which is shown at E, Fig. 48. The projection 7 8 and 7 8, on either side of the leader F, Fig. 48, is the same as the projection 7 8 over the leader Y, Fig. 47.

Fig. 48 also shows a portion of front elevation of the molding G, which miters to the leader head E, as shown.

Fig. 49 is a part of Fig. 47 reversed, showing top brace fastened at top and bottom to prevent the gutter from breaking down

when filled with snow and ice. After the gutter is lined and the top lock is soldered water tight a galvanized iron brace is screwed to the roof boards and into the plank to the front of the gutter, as shown. These braces are placed about 30 to 36 inches apart, and

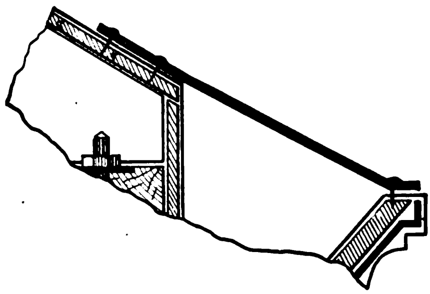


Fig. 49.—Part Section of Gutter, Showing Top Brace.

are made of 3/16 x 1 inch band iron, the same material being used for the inside braces, shown in Fig. 47. The method of bending these braces was fully explained in a previous chapter.

Having now explained how the work is to be constructed and put up, we are in a better position to take the measurements and obtain the patterns.

OBTAINING MEASUREMENTS AND PATTERNS.

Fig. 50 is a rough sketch of the roof plan of a bay window, showing the leader, projection of the leader head and angles of

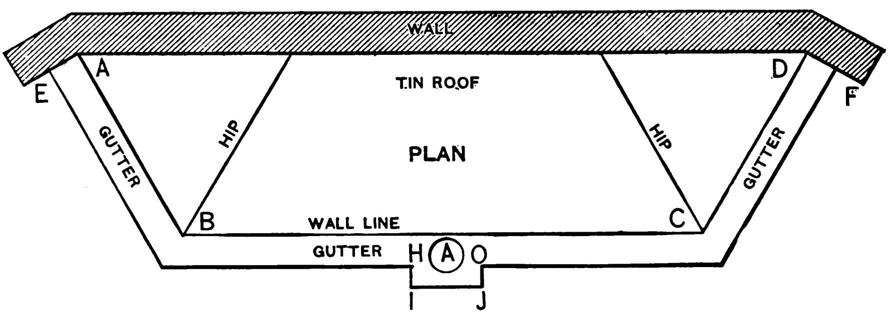


Fig. 50.—Roof Plan of a Bay Window.

walls. The measurement for the moldings would be taken upon the wall line from A to B, B to C and C to D, the angles A B C

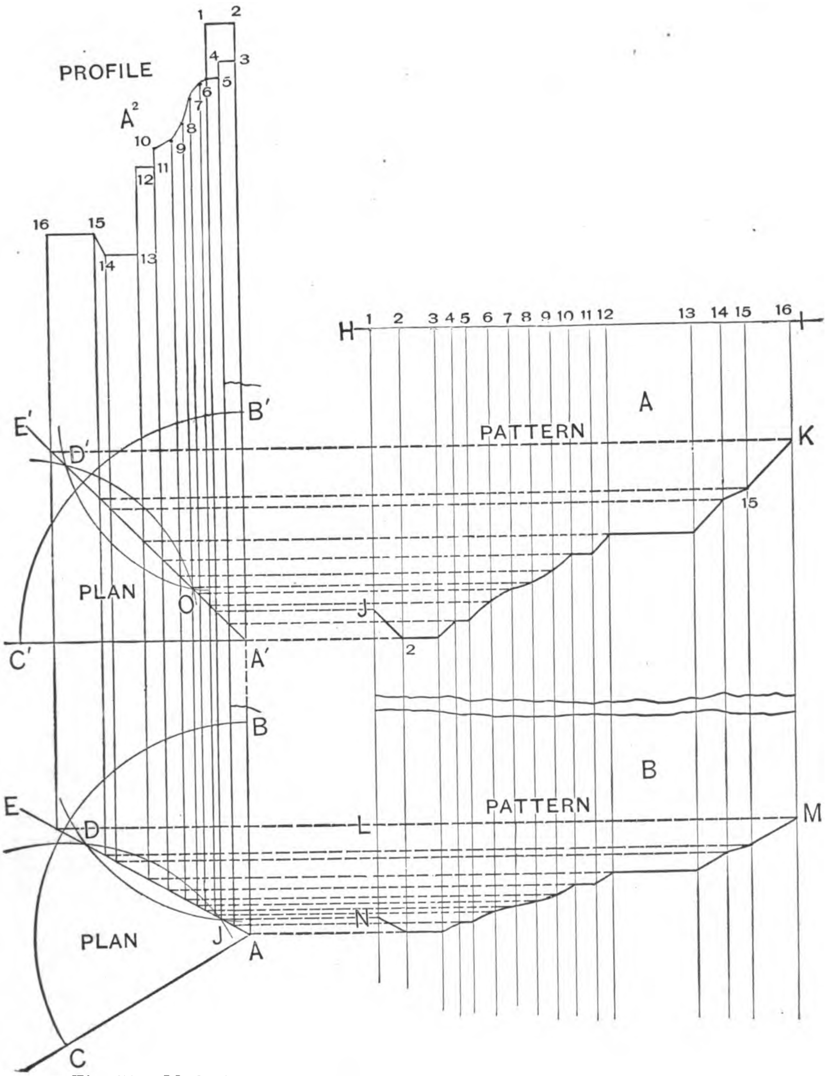


Fig. 51.—Method of Obtaining Two Miter Patterns, Using One Profile.

and B C D being the same. The angle is taken with a bevel, as explained in a previous chapter. The angles at A E and D F are

square. Two miter patterns would be required, one for the angle A B C or B C D and the other for the leader head shown in Figs. 47 and 48.

To obtain the two patterns for the miters proceed as follows: Let A^2, Fig. 51, represent the section or profile of the gutter, shown at F′, Fig. 47. Place the profile in its correct position, as indicated, having the line 12 13 of the profile A^2 perpendicular, and divide the profile into a number of parts, as shown. In line with 2 3 of the profile A^2 place the angle of the leader head, as shown by H I J or I J O in Fig. 50, which is a right angle, as shown by B′ A′ C′ in Fig. 51. Then again in line with 2 3 of the profile A^2, Fig. 51, place the angle of the wall A B C or B C D of Fig. 50, as shown by B A C in Fig. 51.

The next step is to obtain the miter lines of these two angles, for which proceed as follows: Place one leg of the compass at the point A′, Fig. 51, and strike an arc, as shown, from C′ to B′. Now, with C′ and B′ as centers strike the two arcs, as shown intersecting each other at D′ and O. A line drawn through these two intersections will be the required miter line, as shown from E′ to A′.

The same method is employed for obtaining the miter line for the other angle. With A as center strike the arc from C to B; then with C and B as centers strike the two arcs shown intersecting each other at D and J. A line drawn through D and J will be the required miter line, as shown from E to A, Fig. 51. When miters for different angles are required, and the profile is the same, it is well to use this method of placing the miter lines under one another, thereby saving considerable time in spacing the profile for each miter line.

From the divisions on the profile A^2 drop perpendicular lines, as shown, cutting the miter lines E′ A′ and E A. At right angles to the perpendicular lines draw the line H I indefinitely, upon which place the stretchout of the profile A^2, as shown by the small figures 1, 2, 3, 4, etc. At right angles to the stretchout line H I draw lines indefinitely from the small figures, which intersect with lines of corresponding numbers drawn from the intersections on the miter lines E′ A′ and E A parallel to the line H I. Draw lines through these intersections; then H I K J will be the miter pattern for the angle required for the leader head shown at E, Fig. 48; and L M N the miter pattern for the angle taken on the wall line

A B C or B C D, Fig. 50. It will be noticed that the angle B′ A′ C′, Fig. 61, is a right angle, and that the pattern obtained is for a square return miter. The method here shown is the long rule for obtaining square miter patterns, the short method having been explained in a previous chapter.

It is the writer's preference always to use the short method; but when cases arise where miter patterns are required at other than right angles, and a plan must be drawn as B A C in Fig. 51, then we can just as well draw the plan of the right angle B′ A′ C′, as but one operation is required to intersect any number of miter lines.

FULL SIZE PATTERNS.

Fig. 52 shows the method of cutting the full size patterns from a sheet of iron with as little waste as possible. Let A B C D rep-

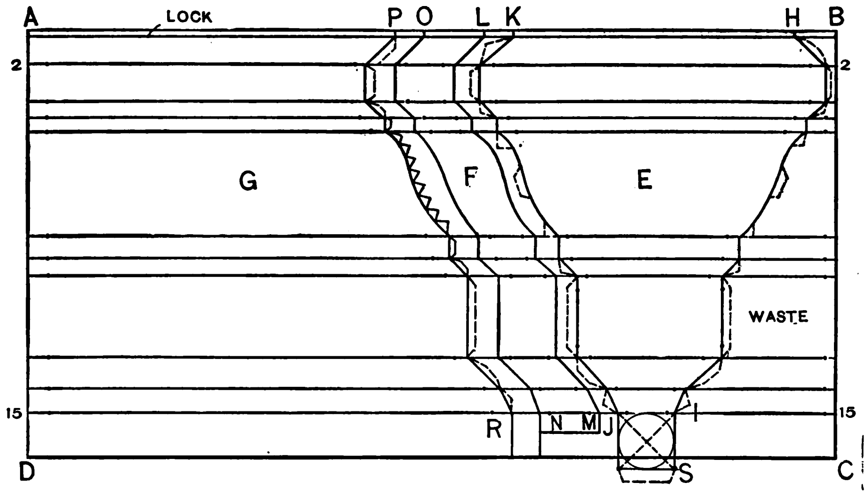


Fig. 52.—Method of Cutting Full Size Pattern.

resent a sheet of iron, upon which the patterns for the leader head are to be laid out.

In practice, the front edge of the sheet at B would be cut straight, so that the lock would show an even edge when bent at the brake, and to which the lock of the gutter lining would be at-

tached, as at J, Fig. 47. A stretchout of the profile A', Fig. 51, is now taken upon a strip of zinc about ⅜ inch wide, upon which the bends of the moldings are dotted off. These dots are now transferred upon the sheet by placing the zinc stretchout even on the line A D, Fig. 52, and dotting off the sheet by means of a scribe awl and hammer. Horizontal lines are then drawn through these dots, which represent the bends of the molding. Next turn the pattern A of Fig. 51, and place the line 2 2 of pattern to correspond with the line 2 2 upon the sheet of iron in Fig. 52, and mark the miter, as shown, from H to I, with a scribe awl. Take the width of the leader Y, Fig. 47, and place it as shown from I to J on the line 15 15, Fig. 52; then, reversing the pattern A of Fig. 51, lay the point 15 of the miter upon the point J on the line 15 15, Fig. 52, and having the line 2 2 of the pattern upon the line 2 2 of the sheet of iron, mark the miter, as shown, from K to J. Then will K H I J or E of Fig. 52 represent the pattern of the face of the leader head shown at E, Fig. 48. As the bottom of the leader head is to be placed on the face E, Fig. 52, and the sheet of iron not being wide enough, a small piece of iron would be soldered on. At right angles to I J draw I S, equal in length to I J, and make a square, as shown. Draw the dotted diagonal lines, the intersection giving the center point from which to strike the circle corresponding to the diameter of the leader Y, Fig. 47, and which would be cut out with a circular shears or snips. This completes the pattern for the entire face and bottom of the leader head, laps being allowed, as shown by the dotted lines.

Where the leader head intersects the moldings, as at H and O, Fig. 50, it is called an inside miter. Therefore the pattern A of Fig. 51 would be placed in such a position on the sheet of iron shown in Fig. 52 that L M would represent a reverse cut, or inside miter. As M N of Fig. 52 would be joined to I S, take the width of I S and place it as shown by M N and L O, and mark the miter cut. Then will L M N O or F of Fig. 52 represent the projection of the leader head, shown at F', Fig. 47, and the miter cut O N of Fig. 52 be connected to the face E on the cuts J K or H I. Now take the pattern A of Fig. 51, and place 2 2 of the pattern upon the line 2 2 of the sheet of iron and mark a reverse or inside miter, as shown by P R, Fig. 52. Allow laps, as shown by the dotted lines

from P to R; then will A P R D or G represent a portion of the molding G, Fig. 48, on which the leader head would be joined, the cut L M on Fig. 52 being joined to P R of the same illustration. The measurement on the molding would be made upon the line R 15 of Fig. 52, that being the bend which sets upon the brick wall. Whatever more molding would be required to obtain the desired length would be joined to the piece G, Fig. 52, having the miter cut the same as B, Fig. 51, for the angles A B C or B C D, Fig. 50.

The face and the return of the leader head E and F, Fig. 52, could be formed upon the hatchet and mandrel stakes, using the ridge and gutter former to make the ogee. In forming the molding G, Fig. 48, it would be best to commence at the lock J, Fig. 47, bending it square with the mallet by using the brake previously illustrated, and then turning over the lock to its proper position with the use of the hatchet stake and mallet. The ogee and the square bends would be made as explained in a former chapter.

CONSTRUCTING GUTTER FOR BRICK WALLS.

Fig. 53 is another form of molded gutter for brick wall, showing the method of fastening it to the wooden wall plate B. A represents the brick wall, B the wall plate, and C the rafter upon which the roof boards are fastened. It will be noticed that part of the molding, from P to E, drops down over the wall, and that the top bend of the molding has an angle iron inserted at H.

After the detail of the molding is made, draw a section of the angle iron in the top edge, as at H, also marking the position of the bolts through angle iron, shown at 1 and 8. Now draw the top flange and lock of the molding, making the top flange as wide as shown at F, so that the bolt 8 passing through the angle iron will have plenty of play room to pass the lock J; or, in other words, the lock J should be placed at such a distance from the bolt 8 that the gutter lining can be locked into the lock J, without interfering with the bolt. When making the detail of the inside brace, care should be taken that it meets the angle iron at 1, and the length of the brace at X X should be such that when the plank L is laid upon the portion of the brace from X to U it will come directly under

the lock J; in this way, when the gutter lining is locked into the molding the seam can be pounded down tight. The other portion of the brace should meet the molding, as shown at 2 and 3, then back to the wall plate with an angle bent upward and nailed to the wooden plate at 6 and 7. The small angle at 4 and 5 is intended to keep the drip molding tight against the wall, without nailing or

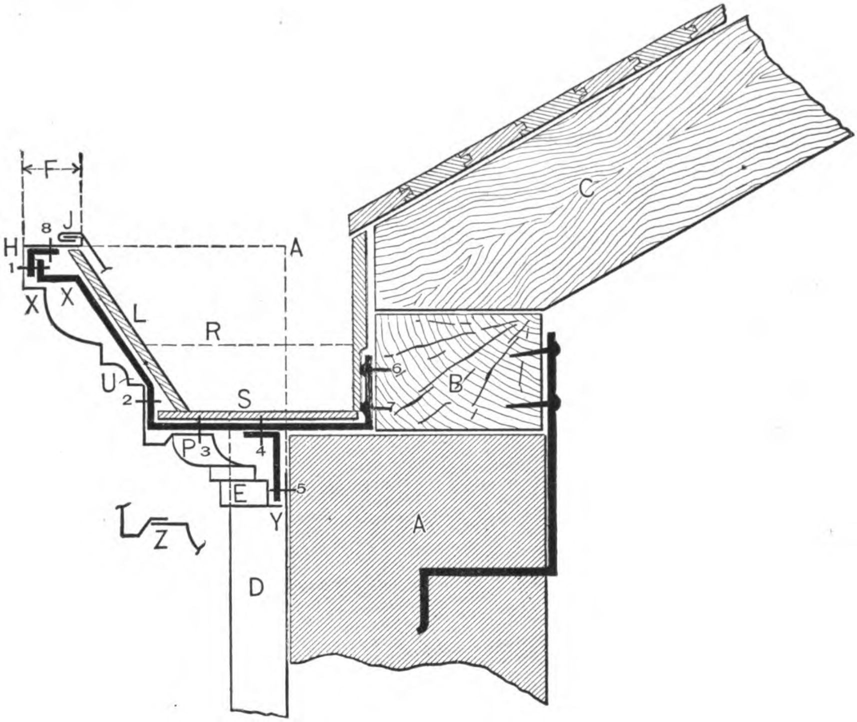


Fig. 53.—Fastening Sheet Metal Molding Against Wooden Plate.

defacing the molding. The angle should be fastened to the main brace by means of a bolt, 4, and then bolted through the flange of galvanized iron at 5. The hole 5 should be countersunk, so that a smooth surface is obtained. Care should be taken in bolting the angle 4 5 to the main brace that one is exactly like the other, otherwise the drip molding will not lay even against the wall. The

length of the stove bolt which is inserted into the hole 5 should not be greater than the inside width of the member Y of the drip molding.

PUTTING UP THE GUTTER.

After the molding is formed and set together to the required length the angle iron is held in position with hand vises, as explained in a previous chapter, until the top bolts are all inserted from the bottom up, as shown at 2, Fig. 55. After the top bolts

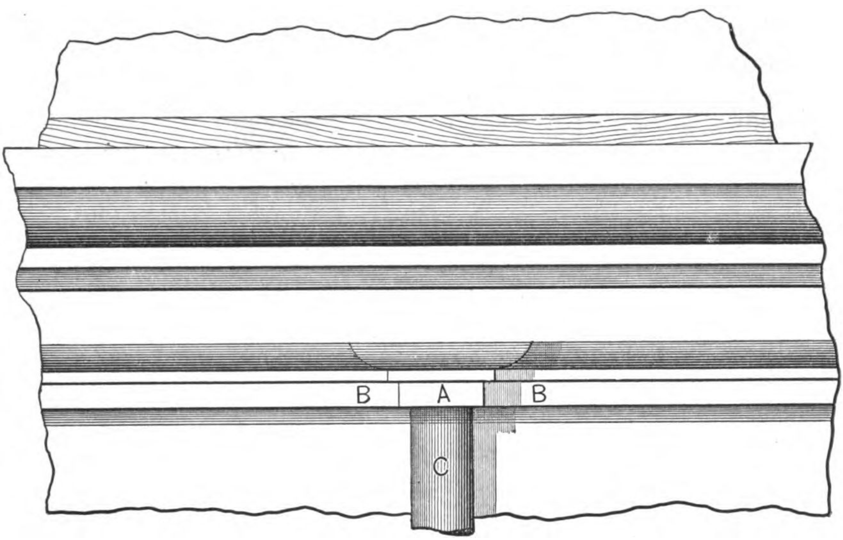


Fig. 54.—Front Elevation of Molding, Leader and Head.

are all in place and the nuts fastened the front bolt 1 is placed through the molding, angle iron and brace and fastened on the inside; the bolts are also inserted at 2 and 3, Fig. 53, and the angle bolted to the main brace at 4, being careful to have the distance from the angle 4 5 to the angle 6 7 the same as the distance from the front of the wall to the wall plate B. The angle irons and braces can all be put in the molding in the shop. Let us suppose the molding is 28 feet in length, in which there are ten braces. In hoisting up on the wall two ropes would be required, looping and

fastening each rope on each side to the third brace from the end and tying around the brace X, Fig. 53. When the molding is up set it on the wall, and drive two anchor nails into the wall plate B at 6 and 7, thus drawing the drip Y tight against the wall. The gutter is now lined with wood by the carpenter, S being the lowest point and R the highest point, it being blocked up with wood, as explained in a previous chapter. The gutter is then lined with either tin, copper or galvanized iron and locked into the lock of the molding at J, Fig. 53. In Fig. 55 is shown a part of Fig. 53

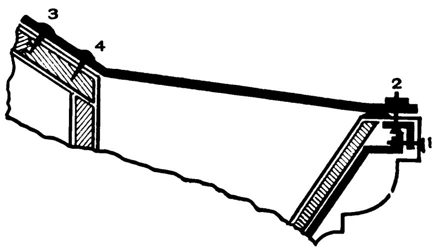


Fig. 55.—Part of Gutter with Top Brace.

reversed, with the top brace bolted to the angle iron and screwed to the roof board. At 1 is shown the bolt, passing from the outside through the molding, angle iron and brace and fastened on the inside. In putting on the top brace, shown in Fig. 55, care must be taken when loosening the nut of the bolt 2 that the bolt does not fall inside of the molding. To prevent this lay a strip of wood on to the part of brace X X, Fig. 53, before the gutter is planked, to uphold the bolt 8 when the nut is loosened.

After the top brace is bolted at 2, Fig. 55, screw to the roof planks, as shown by 3 and 4. This top brace will keep the gutter from bending down from the weight of the snow and ice. In milder climates, where the snow is not considered, the top braces could be omitted.

Let D, Fig. 53, represent a square leader, meeting the lowest point of the gutter S, as shown by the dotted lines. To make a neat finish where the leader D cuts through the drip molding, a small head is made for the leader, having the same projection as the leader D, as shown by P E. Fig. 54 is a portion of the front

view of molding, leader and leader head, the section of which is shown in Fig. 53. B B represents part of the drip molding, A the leader head and C the leader.

Having now explained the method of construction, as shown by the front and sectional views, we will proceed to take the measurements and obtain the patterns.

TAKING MEASUREMENTS AND MAKING PATTERNS.

Let A B C D, Fig. 56, represent the plan view of a tin roof, showing the brick walls and the molding on the front from A to B. O represents the section of a square leader, shown in Fig. 53 at D, and in Fig. 54 at C. When measuring the length of the molding, measure upon the wall line from 1 to 2, Fig. 56. As no return miters are required in the molding, two flat heads, shown at A and B, Fig. 56, are placed on each end of the molding. As the water

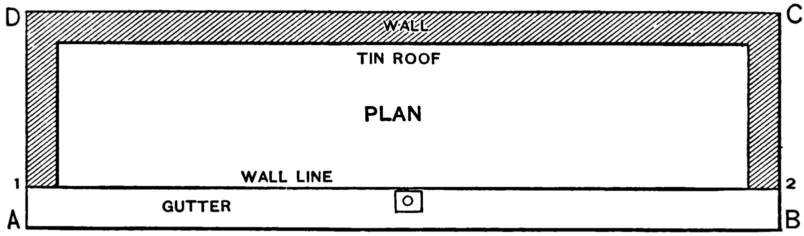


Fig. 56.—Roof Plan, Showing Leader and Gutter.

is to run to the center of the building, the leader will be placed at O, Fig. 56,with a projecting leader head to the hight of the drip molding, the face of which is shown in Fig. 54 at A, and the projection in Fig. 53 at P and E.

To obtain the patterns for the flat heads for the moldings, proceed as follows: In line with the wall shown in Fig. 53, draw a dotted line as shown from 5 to A′, and at right angles to it draw a dotted line, H A′, meeting the top bend of the molding H.

Transfer this angle, including the profile of the molding shown in Fig. 53, upon a piece of galvanized iron, by placing the galvanized iron underneath the detail of the molding and pricking through by means of a scribe awl and hammer. The result is

shown in Fig. 57 by A B C. In pricking through the profile on detail, it is best first to divide the profile into a number of parts, so as to obtain the stretchout, and then prick through these divisions.

As the molding usually is made to represent stone after being painted and sanded, and as stone work always shows the bearing upon the wall from the side view, it is well to add 4 inches or more to the pattern of the flat head, as shown from D to E, in Fig. 57.

Now take the stretchout of the top flange of the molding,

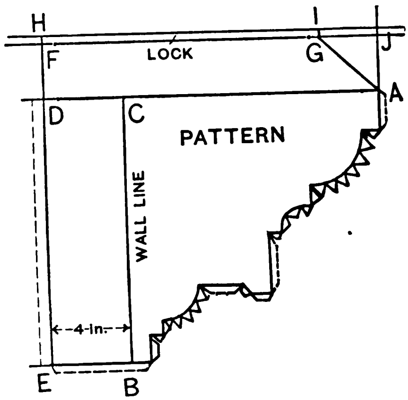


Fig. 57. - Pattern for a Flat Head.

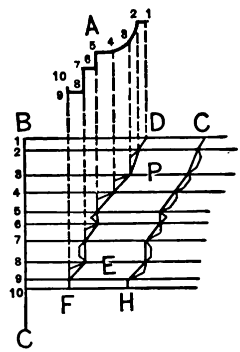


Fig. 58.—Pattern for Return on Leader Head.

shown from H to J in Fig. 63, and transfer it as shown by F and G, Fig. 57, at right angles to A D, and add the lock, as shown from H to I.

At right angles to D A, Fig. 57, draw the line A J. Take the distance of the top flange D F in Fig. 57 in the dividers, and placing one leg on the point J strike an arc intersecting the line F G at G. Draw a line from A to G, which will be the miter for the top flange of the head, mitering with the top flange of the molding at right angles in plan, shown by 1 A B or A B 2 in Fig. 56. At right angles to F G, Fig. 57, draw G I, which completes the patterns. Allow lugs, as shown.

For the pattern of the leader head proceed as follows: Draw a duplicate of the profile of the drip molding, shown in Fig. 53, at A, Fig. 58. Divide A into a number of parts, as shown. Now

draw any perpendicular line, as B C, upon which place the stretch-out of the profile A at right angles to the line B C, and from the small figures draw lines indefinitely, as shown. From the divisions obtained in the profile A drop perpendicular lines intersecting the corresponding numbers drawn at right angles to the stretchout B C. A line traced through these intersections from D to F will be the required miter pattern. Now take the distance of the projection of the leader, shown at D, Fig. 53, and with the divider's measure the distance from the miter cut D F, Fig. 58, on the lines 1, 2, 3, 4, etc.; trace a line through the points, as shown, from C to H. Then D F H C, or P and E, will be the pattern required for the projection of the leader head shown by P E, Fig. 53.

In Fig. 59, B A and B represent a sheet of iron, on which part

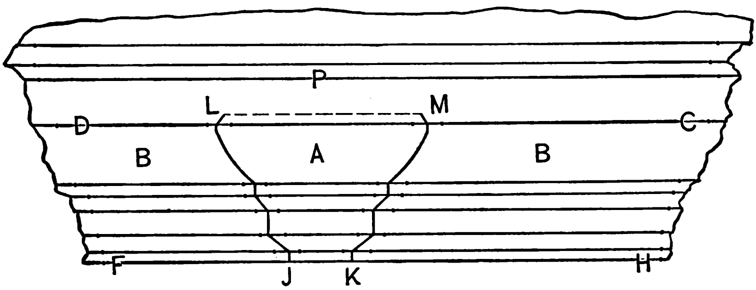


Fig. 59.—Laying Off the Miter on the Sheet.

of the bends of the molding have been lined, as shown. Let us suppose that, the length of the molding having been obtained, the leader will come in the position on the sheet shown by J K. Now use the pattern P E, Fig. 58, and place the point F, Fig. 58, upon the point K, Fig. 59, placing the line F H of Fig. 58 upon the line K H of Fig. 59, and draw the miter line shown from M to K. Now have J K, Fig. 59, the width of the face of the leader shown at C, Fig. 54. Reverse the pattern P E of Fig. 58, and place the point F upon the point J, Fig. 59, placing the line F H upon the line J F, and mark the miter line shown from L to J. As the projection of the leader head comes out as far as up to the line P, Fig. 59, when the molding is formed, we can add a small lap, as shown,

from L to M, to the pattern A of Fig. 59. Now, taking the right handed snips, cut out the pattern A of Fig. 59, commencing at the point K, on the miter line up to M, over to L and down to J.

A in Fig. 60 represents the pattern for the face of the leader head which was so obtained. It will be noticed that the face A of Figs. 59 and 60 has no lap attached, the same being the case with B and B of Fig. 59. For this reason laps have been added to the pattern for the return on leader head, shown at P and E in Fig. 58. The miter cut C H, Fig. 58, is joined to the cuts M K or L J, Fig. 60, and the cut D F, Fig. 58, to the cuts M K or L J, on the sheet B B, Fig. 59, when setting together.

In forming the leader head, use the ridge and gutter former

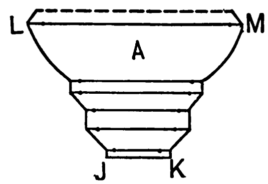


Fig. 60.—Pattern for Face of Leader Head.

for bending the curves and the hatchet stake for making the square bends. As the profile of the molding shown in Fig. 53 is rather complicated to bend in one piece on the brake, it is better if we make the molding in two sections, as shown at Z, Fig. 53; soldering the two sections in the corner of the drip, using the gutter tongs to make the drip Y and the hatchet stake to make the lock J.

Leader Pipes and Fastenings.

Let Fig. 61 represent a section or profile of a round leader, the seam being shown at A. Fig. 62 is a rectangular, or, as it is commonly called, a square leader, the seam being shown at B. The seam in Fig. 62 is supposed to lay against the wall of the building, but it is better to place it as shown at B′, so that in case the leader bursts the seam can be readily repaired without removing the leader. Fig. 64 represents a section of an octagon leader, the seam being shown, as indicated at E in Fig. 63. To draw the

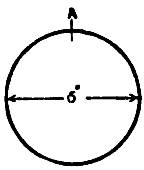


Fig. 61.—Section of Round Leader.

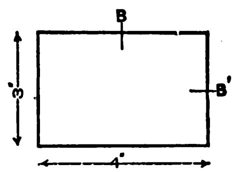


Fig. 62.—Section of Square Leader.

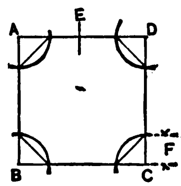


Fig. 63.—Obtaining Broken Corner for Octagon Leader.

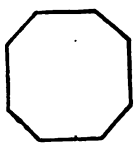


Fig. 64.—Section of Octagon Leader.

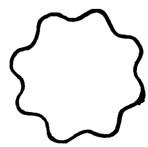


Fig. 65.—Section of Corrugated Leader.

shape of the octagon leader, shown in Fig. 64, to full size, proceed as follows: Draw a square figure to the required size, as shown by A B C D, Fig. 63, and let F indicate the width of the corner which is to be broken. With C as center and F as radius, strike an arc, cutting the lines B C and C D; then again, with the same radius, and with D A and B as centers, strike the three arcs as shown. Draw lines through the intersections made upon the square, which will give the section of the octagon leader required, as shown in Fig. 64. Fig. 65 represents a section of a corrugated leader, which

can only be made by those having special machinery for that purpose, but can be obtained in 8-foot lengths from dealers in tinners' supplies.

Fig. 66 is a perspective view of a round leader riveted and crimped at A. If the tinner has no crimping machine it is advisable to obtain one, as a great amount of time and labor is saved over the old method of drawing in the pipe on the mandrel stake. Fig. 67 is a perspective view of a square or rectangular leader, and

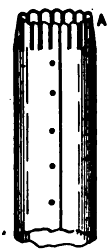


Fig. 66.—Round Leader Riveted and Crimped.

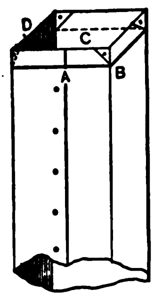


Fig. 67.—Notching Flange on Square Pipe.

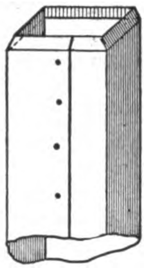


Fig. 68.—Square Riveted Leader with Flange Complete.

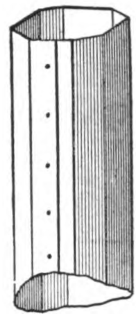


Fig. 69.—Octagon Leader Riveted.

shows the method of notching the flange joining into the next joint of pipe. Let us suppose that a 1-inch flange is required; then placing the width of the dividers to 1 inch, scribe a line round the top edge of the joint of leader, as shown by A B C D, Fig. 67, and measuring with the eye about ½ inch from the corner, cut a notch on each corner with the snips, as shown by the four dots over the lines A B C and D. It will be noticed that the flange is notched once on each side of the leader and the flanges bent but slightly toward the inside of the leader, thus giving the appearance as shown in Fig. 68. Fig. 69 is an octagon leader, the flange for joining being notched in the same manner as described in Fig. 67, the only difference being that the square leader is notched on four sides, where the octagon leader would be notched on eight sides. Fig. 70 is a perspective view of a corrugated leader, the flange A being drawn in in manufacture.

Fig. 71 shows the method of drawing a full size diagram for obtaining a fractional part of an inch, which is to be used when obtaining the circumference of any size of round pipe. Let us suppose that the diameter of the pipe shown in Fig. 61 is 6 inches; the rule for obtaining the circumference of any round pipe is to multiply the diameter by 3.1416, which is a little more than $3\frac{1}{7}$; therefore the rule used in practice is to multiply the diameter by $3\frac{1}{7}$. To obtain the circumference of a pipe 6 inches in diameter, multiply 6 inches by $3\frac{1}{7}$, which equals $18\frac{6}{7}$ inches without lap ($\frac{3}{4}$-inch lap is usually given). To obtain the $\frac{6}{7}$ inch, construct the diagram as above referred to as follows: Draw any line, as A O, Fig. 71, to any desired length, upon which lay off seven

Fig. 70.—Corrugated Leader.

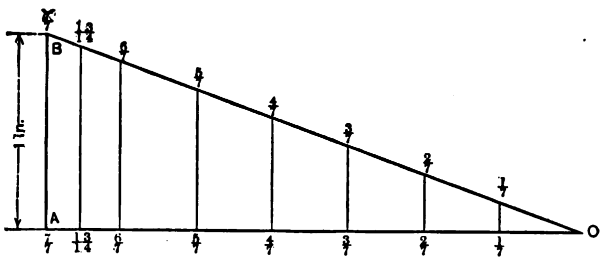


Fig. 71.—Diagram for Obtaining Fractional Parts of an Inch.

equal spaces, and at right angles to A O draw the line A B, in length equal to 1 inch, as shown; draw a line from B to O, as shown. From the seven spaces obtained upon the line A O, as shown by $\frac{1}{7}$, $\frac{2}{7}$, $\frac{3}{7}$, $\frac{4}{7}$, etc., draw lines at right angles to A O, intersecting the line B O. Then will $\frac{1}{7}$ $\frac{1}{7}$ represent $\frac{1}{7}$ inch, $\frac{2}{7}$ $\frac{2}{7}$ represent $\frac{2}{7}$ inch, $\frac{3}{7}$ $\frac{3}{7}$ represent $\frac{3}{7}$ inch, and so on until the full inch is obtained. Then will $\frac{6}{7}$ $\frac{6}{7}$ in Fig. 71 represent $\frac{6}{7}$ inch, to be added to the 18 inches necessary for the circumference of a 6-inch pipe.

Suppose the circumference was desired of a pipe $5\frac{1}{2}$ inches in diameter, then multiply $5\frac{1}{2}$ inches by $3\frac{1}{7}$, and the result would be $17\frac{2}{7}$ inches; $\frac{2}{7}$ $\frac{2}{7}$, shown in the diagram in Fig. 71, would represent the $\frac{2}{7}$ inch desired. Then again, if the circumference of

a pipe was required which was $4\frac{3}{4}$ inches in diameter, the same rule would be employed. Multiplying $4\frac{3}{4}$ inches by $3\frac{1}{7}$, the result would be $14\frac{13}{14}$ inches; as $\frac{6}{7}$ equals $\frac{12}{14}$, then bisect the space $\frac{6}{7}$ $\frac{7}{7}$ on the line A O, Fig. 71, as shown by the line $\frac{13}{14}$ $\frac{12}{14}$, which will be $\frac{13}{14}$ inch. By using the method shown in Fig. 71 any fractional part of a given hight can be obtained. If elbows were required for the round pipe it would not be necessary to figure out the circumference, as the stretchout of the pipe would be taken, on which to cut the miter pattern, and would at once give us the desired circumference. Suppose that a leader, the section of which is shown in Fig. 62, was to run down straight, no elbows being required; then, knowing the size the leader is to be, no drawing would be required, the stretchout being figured thus: size of leader 3 x 4 inches; $3 + 4 + 3 + 4 + \frac{3}{4}$ lap $= 14\frac{3}{4}$ inches, including lap.

PUNCHING THE LEADER.

Fig. 72 shows a strip which is used for marking off the rivet holes on the pattern when making leaders. In making strong, substantial pipe it is advisable to punch the holes before the leader

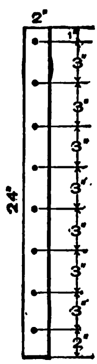


Fig. 72.—Strip for Marking Rivet Holes.

is rolled up, and have the holes not less than 3 inches apart. To get the holes on one side of the pattern the same as on the other, so that they will meet when rolled or formed up, cut a strip of iron 2 inches wide by 2 feet long, or as long as the joint of pipe, and divide into spaces as shown in Fig. 72. It will be noticed that the

first hole from the top is 1 inch from the end and the rest of the holes punched every 3 inches, leaving the last hole 2 inches from the end, as shown, and which will be the side where the leader will be crimped. The holes will be punched with a rivet punch, Fig. 73, the punch being a trifle larger than the rivets used, so as to

Fig. 73.—Rivet Punch.

allow the rivets to slip in easily. As leaders are usually cut from 2 foot wide iron, let us suppose that we have a pattern piece of iron before us which is 2 feet long by the circumference or stretchout of the pipe required; the lap used for riveting the leader being ¾ inch, set the dividers to one-half of ¾ inch, which is ⅜ inch, and mark a line upon each side of the leader pattern where the holes are to be punched. Now take the strip shown in Fig. 72, and place it upon the pattern of the leader so that the center of the holes will come directly upon the two lines just marked, one at each side. Care should be taken not to reverse the strip when marking the holes upon the opposite side of the pattern, otherwise they will not meet when rolled or formed to shape.

ROLLING THE LEADER.

In Figs 74, 75 and 76, A and B represent the sections of the front rolls of a stove pipe former, and C, C and C in the same

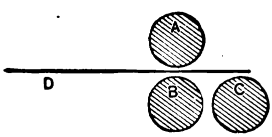


Fig. 74.—First Operation in Forming Round Leader.

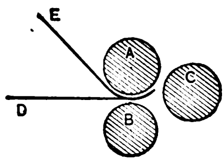


Fig. 75.—Second Operation.

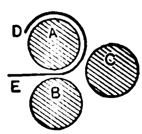


Fig. 76.—Third Operation.

three figures the rear or back roll, which is raised or lowered to give the pipe the desired curve. If a sheet was run through the rolls as in Fig. 74 it would run out straight at the other end, showing that the rear roll C is the roll which forms the pipe to the re-

quired circle. Let C in Fig. 75 represent the roll raised to its proper position to obtain the circle required.

When rolling the leader as in Fig. 75 place the sheet D in the position shown and turn the handle of the roll until the rolls grasp the sheet about ½ inch; now hold the handle steady with the right hand and raise the sheet with the left until it has the position shown at E, Fig. 75; this at once gives the small curve as shown and allows the sheet to pass up over the rear roll C. The handle is now turned until the leader has the required circle. If the tinner has the service of a stove pipe former, having what is called a slip roll, then the roll A, in Fig. 76, can be raised at one end and the pipe drawn off after it is formed; but if an old style roller is in use, then when the pipe has the position as shown at D, Fig. 76, the fingers or a piece of heavy metal bent V shape should be placed between the pipe and top roll, and turning the handle, draw out the iron at D, so as to prevent it from again entering between the rolls and until the side E has passed through. Should an old style roller be in use, it is well to raise the back roll C a little higher, thereby making a smaller circle, so as to compensate for the drawing out at D, as before explained. After the leaders are all rolled they are riveted, using burrs if desired, and then crimped and soldered together in the usual 10-foot lengths.

BENDING SQUARE LEADER.

In Figs. 77, 78, 79 and 80 are shown enlarged sections of a country cornice brake, previously described, which will be used to

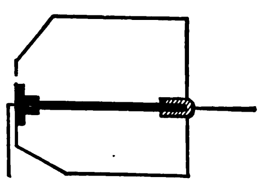


Fig. 77.—Forming Square Leader on Brake. First Operation.

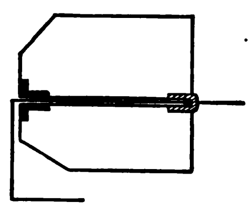


Fig. 78.—Second Operation.

bend off the square leader, in which there are four operations required. Let us suppose that the leader has the shape shown in Fig. 62, and that the seam is to be at B′. After the bends are

dotted off on the sheet, place it in the brake and make the first bend, as in Fig. 77; draw out the sheet to the next dot and make the second bend, as in Fig. 78; then again draw out the sheet to the third dot, and make the third bend, as shown in Fig. 79. When making the fourth bend, shown in Fig. 80, it will be noticed that the bottom of the leader strikes against the bottom of the brake; therefore, after making the third bend, shown in Fig. 79, draw it back again as shown by the dotted line in the same figure. Draw

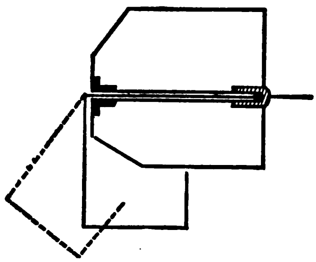


Fig. 79.—Third Operation.

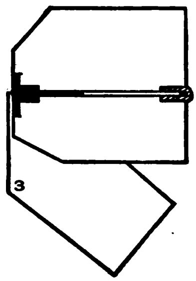


Fig. 80.—Fourth Operation.

out the sheet to the fourth dot, and make the fourth bend, as in Fig. 80. A hatchet stake will now be required, upon which to make the bend 3, Fig. 80, square.

A HOME MADE HATCHET STAKE.

Fig. 81 is a perspective view of a home made hatchet stake, 8 feet in length. The leader is but 2 feet in length, but the object in making the stake 8 feet long is so that it can be used for making the different bends in a molding 7 feet long, if so required. The construction of the stake in Fig. 81 is clearly shown. It will be noticed that the base board is 1 foot wide by 9 feet long by 1 inch thick, upon which the 2½ x 4 inch upright joists are placed, 3 feet in hight, braced with 2 x 4 inch split joists on the inside, and nailed or screwed, as shown at C C. Obtain a piece of angle iron ¼ x 2 x 2 inches, and 9 feet in length, made perfectly straight, and screw it upon the upright joists, as shown. The top edge of the angle iron should be filed off so that it will appear as shown at A, Fig. 82. When bending off the angle of the leader above

referred to, place the leader in the position shown in Fig. 82, and press down the corner C, which will then make a sweep, as shown by the dotted lines C B and E D, Fig. 82, and will look when finished as shown in Fig. 83.

When making the band A, Fig. 83, the corner will be rather

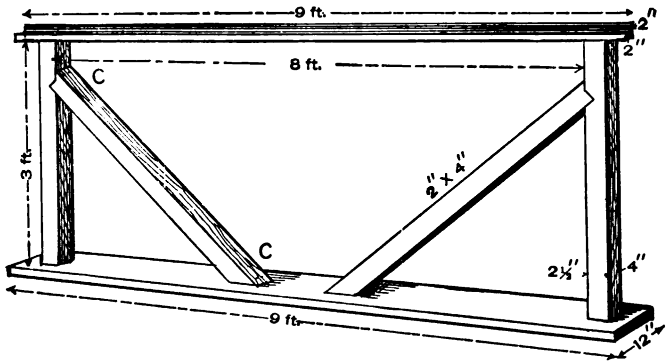


Fig. 81.—*Home Made Hatchet Stake,* 8 *Feet Long.*

round. To obtain a square corner use the wooden mallet. Do not use the hammer, as the edge A of the angle iron would be flattened. The method used for the square leader would be followed in forming the octagon leader, Fig. 64. Before riveting the square leader it should be first tacked and soldered, care being taken that the

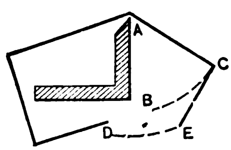


Fig. 82.—*Bending Right Angle. First Operation.*

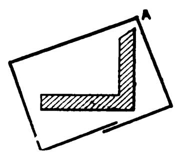


Fig. 83.—*Second Operation.*

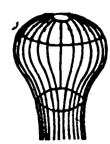


Fig. 84.—*Leader Strainer.*

pipe is not lopsided. After the joints are soldered and riveted they are put together in the usual 10-foot lengths.

Fig. 84 is a galvanized wire strainer, which is placed over the inlets of leaders to prevent them from stuffing up. They can be obtained from 2 to 12 inches in diameter.

LEADER HOOKS AND COVERINGS.

In Fig. 85 is shown a hook which is used for fastening plain leader to a wall, the blows being struck against A when driving the hook in place.

Fig. 86 represents a hinged leader hook, used for putting up plain leaders when it is desired that the leader stand off from the wall, so that in case of an overflow or the leader bursts the wall will not be injured.

When driving the hook into the wall it is opened and the blow struck against that portion indicated by A of Fig. 86.

In using hinged leader hooks they must first be driven into the wall before the leader can be placed in its proper position; but

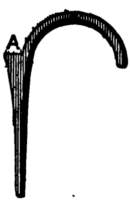


Fig. 85.—Plain Leader Hook.

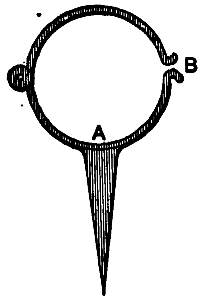


Fig. 86.—Plain Hinged Leader Hook.

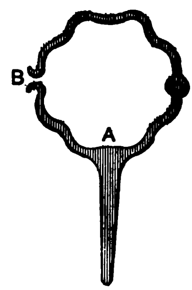


Fig. 87.—Corrugated Hinged Leader Hook.

in using the hook shown in Fig. 85 the leader is first placed in position against the wall and then the hook driven over it.

Let us suppose that a straight plain leader is to be put up, having no bends whatever, and that hinged hooks as shown in Fig. 86 are to be used. After having marked the position where the leader is to be placed, drive the first top hook as far as the leader is to project from the wall. Now drop a chalk line with a weight attached at the bottom so as to keep it stretched, fastening the line to the center of the hook A, shown in Fig. 86. Now drive as many hooks as are required, being careful that the chalk line meets the center A of the hook, Fig. 86. The leader is now placed in the hooks, the hinges closed and fastened with wire at B, using a pair

of pliers with which to twist the wire. By using hinged hooks a great amount of time and labor is saved in case of repairing, or if a new leader was required the wire and hinge would simply be opened, the old leader removed and the new one put in place. The hinges would then be closed and fastened with new wire.

Fig. 87 represents a hinged hook for corrugated leader; the same method being employed to fasten the hook and leader as explained for that shown in Fig. 86. In Fig. 88 is represented a wall hook used for a square leader, the same as would be employed

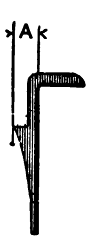


Fig. 88.— Wall Hook for a Square Leader.

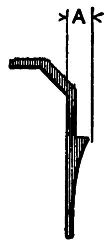


Fig. 89.—Wall Hook for an Octagon Leader.

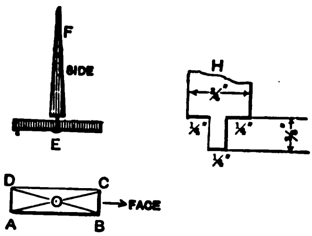


Fig. 90.—Side and Face Views of a Home Made Leader Hook.

to fasten such a leader as that shown in Fig. 91. In Fig. 89 is represented a wall hook for fastening an octagon leader in the same manner as shown in Fig. 91. The hooks indicated in Figs. 85, 86, 87, 88 and 89 can be purchased from dealers in tinners' supplies, from whom catalogues can probably be obtained upon application.

In Fig. 90 is shown the side and face view of a home made leader hook; A B C D representing the face view, E F the side view, and H the measurements from which to cut the wedge F, so as to rivet on to the face as shown at E. The face or front of the hook, A B C D, Fig. 90, is made from a piece of 3/16 x 1 inch band iron, making the length of A B or C D, Fig. 90, equal to the width of the square or octagon leader, which is to lay against the hook, as shown in Fig. 94.

After the piece of band iron is cut to the required length, draw two diagonal lines through the same, as shown from A to C and B to D in Fig. 90, the intersection being shown at O. This indicates the center where the ¼-inch hole is to be punched, in which

to place and rivet the wedge, as shown at E, Fig. 90. The wedge F, Fig. 99, can be made from 1/4 x 3/4 inch band iron. Heat the end F in the forge to almost a white heat, and then with quick suc-

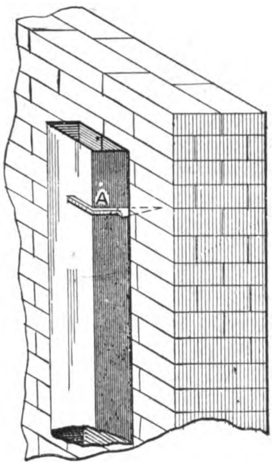


Fig. 91.—Square Pipe Fastened Against a Wall with Hook Shown in Fig. 88.

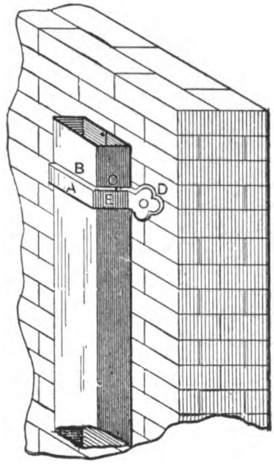


Fig 92.—Method of Covering the Hook with Metal.

cessive blows with the hammer stretch it to almost a point, wedge shape, as shown. Three inches of the wedge driven into the wall will be sufficient to uphold the leader. Now, if the leader is to project 2 inches over the wall line, and 3 inches are required to drive into the wall, then the wedge must be cut 5 inches in length. The rivet end of the wedge, shown at E, Fig. 90, is cut and filed as shown at H, Fig. 90, the full size measurements being given.

The 1/4 x 3/8 inch rivet shown at H must be filed perfectly round so as to fit the 1/4-inch round hole punched in the face of the hook, shown at O, Fig. 90, and to which it will be riveted as shown at E, Fig. 90. After it is riveted the rivet head E should not project over the face of the hook any more than 1/8 inch, so that the leader will lay well against it. In driving the hooks into the wall care must be taken that they are all on a plumb line, using the chalk line as before explained, and that each hook has the same

projection over the wall as the other, otherwise the leader will not lay tight against the hooks.

In Fig. 91 is shown a perspective view of a square pipe, or leader, fastened against a wall by means of the hook shown in Fig. 88. It will be noticed that the riveted side of the square leader

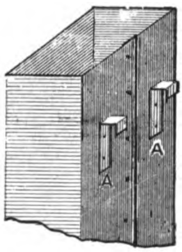


Fig. 93.—Method of Soldering or Riveting the Angles on Leaders.

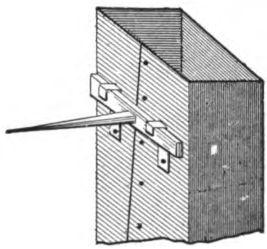


Fig. 94.—Angles Resting on the Hook Shown in Fig. 90.

shown in Fig. 91 lays tight against the wall and that the hook A of the figure corresponds to the hook A of Fig. 88, and is driven into the joint of the brick work, as shown in Fig. 91. If the hook

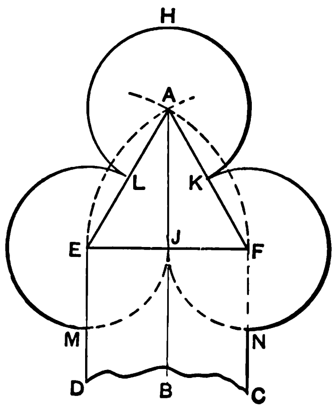


Fig. 95.—Method of Obtaining the Geometrical Figure or Leaf Shown at D, Fig. 92.

was left in this position it would make a bad appearance; to overcome which a galvanized sheet metal covering is placed over the

hook, using galvanized iron for a galvanized iron leader and copper covering for a copper leader. The appearance is shown at A in Fig. 92. The covering A in Fig. 92 is slipped over the hook shown at A in Fig. 91 and soldered along the top of the covering and against the leader, as shown at B and C, Fig. 92, thus making a clean and neat appearance.

CONCEALED HANGERS.

In Fig. 93 is a perspective view of a square leader, showing the method of soldering or riveting to the leader the angles for

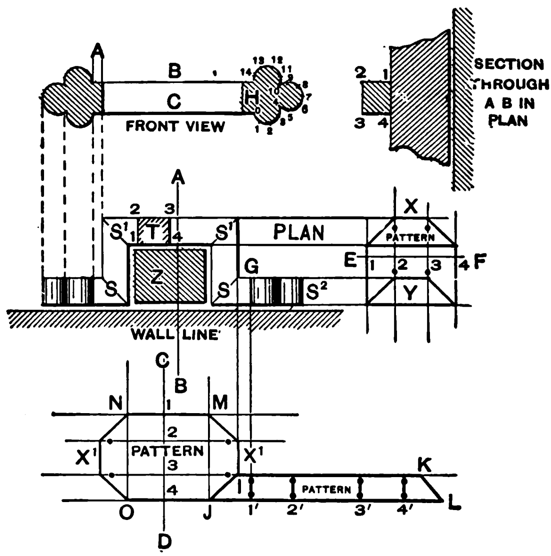


Fig. 96.—Front, Plan and Sectional Views of Hook Covering; also the Patterns.

fastening the pipe or leader which is used in connection with the home made leader hook in Fig. 90. These angles can be made about 1½ inches wide and so long that two rivets can be riveted through the leader and angle with ease. If it is not convenient to rivet the angles they can be well soaked with solder, which also gives a good hold. The hooks on these angles should be made a little larger than the size of the face of the leader hook shown in Fig. 90, which is $^3/_{16}$ x 1 inch in size. When making the angles

use about No. 14 gauge iron. In Fig. 94 is shown a perspective view of the leader and angle resting or hanging on the hook after the latter has been driven into the wall. These hooks can also be used for round leaders of any size by simply bending the face of the hook shown in Fig. 90 to the required circle. It is usual to place these hooks about 8 feet apart, being careful about having them on a plumb line, as before explained, and then taking a long wooden rod about 1½ x 1½ inches by 15 to 18 feet in length and laying it against the hooks driven in the wall, mark off the hooks on the rod, then transferring these distances to the leader, solder or rivet on the angles shown in Figs. 93 and 94. In putting up leaders with the use of these home made hooks a little more time may be required, but when the job is completed the leader gives a neat appearance because no hooks or bands are exposed to view. In putting up any kind of leaders or hooks the latter are generally driven into the wall by reaching out of the windows. Sometimes the leader is placed where the windows are too far distant, and then a sitting scaffold must be used, a device which will be found very convenient when executing such a job.

PATTERNS FOR COVERINGS.

In Fig. 95 is shown the method of obtaining the geometrical figure or leaf for the sheet metal covering as indicated at D, Fig. 92. To obtain the leaf proceed as follows: Draw any perpendicular line, as A B, Fig. 95, upon either side of which place the half distance of the width the covering A, Fig. 92, is to have, as shown by the line E F, drawn at right angles to A B in Fig. 95. Now upon this line construct an equilateral triangle, or a triangle having three sides equal. With F, Fig. 95, as center and F E as radius strike an arc, as shown, from E to A; then with E as center and E F as radius strike another arc, intersecting the first one at A. Now draw the line from A to E and from A to F; then will A E F represent the triangle desired. It will be noticed that the line A B, Fig. 95, bisects the line E F at J. Now with F as the center point for the compass and with F J as radius strike an arc, cutting the line A F at K; then with A as center and with the same radius strike another arc, cutting the line A E at L. Then again with E as center and using the same radius strike an arc from the

point L, meeting the point J on the line E F. Now at right angles to E F, or parallel to A B, drop lines as shown from E to D and F to C. The distance N to C, or M to D, can be made to the width desired, as indicated at A, front view, Fig. 96. Then will C N H M D represent the leaf desired. It should be understood that the width of the covering shown from E to F in Fig. 95 gives the basis for obtaining the center point from which to strike the arcs, and therefore makes the leaf in proportion to the width of the covering.

In Fig. 96 are shown the front, plan and sectional views of a hook covering, including the patterns. Let Z in plan represent the size of the leader used, lying against the wall, as shown, around which is placed the plan view of the covering. The width of the front view of covering shown from B to C should be made from 1 to 1½ inches, according to the size of the pipe used; while the width shown from 1 to 2 or 3 to 4 in plan, or what is the same, the width from 1 to 2 or 3 to 4 in the section, should be made a little wider than the width of the hooks shown at A, Fig. 88, or A, Fig. 89, so that the covering will slip over easily.

After having the front and plan views drawn in their proper position to each other, as shown by the dotted lines, draw a section of the covering in the plan, as shown at T, from which to obtain the stretchout. S, S′, S′, S represent the four miter lines in plan. To obtain the patterns for the coverings proceed as follows: At right angles to the line S′ S′ in plan draw the stretchout C D, as shown, upon which place the stretchout of the section T in plan, as shown by the small figures 1, 2, 3 and 4, corresponding in number to those on the section. Now at right angles to the stretchout C D draw lines indefinitely through the small figures, as shown, which intersect with lines of corresponding numbers drawn from the miter lines S′ and S′, parallel to C D. A line traced through these intersections will be the required pattern for the front of the covering shown at A, Fig. 92. For the pattern of the side of the covering, shown at E, Fig. 92, proceed as follows: Parallel with the line S′ S′, Fig. 96, draw the stretchout E F, upon which place the stretchout of the section T of the plan view, as shown by the small figures 1, 2, 3 and 4 on the stretchout line E F. At right angles to the stretchout draw lines indefinitely through the

small numbers, as shown, which intersect with lines drawn at right angles to the line S′ S, from the miter lines S′ and S. A line drawn through these intersections will be the required pattern for the two sides of the covering, as shown at E in Fig. 92. The pattern for the front and sides of the covering can be made in one piece if desired. In Fig. 97 let A represent a duplicate of the pattern of the front, as shown by M N O J, Fig. 96, and B B, in Fig. 97, represent duplicates of the pattern of the side shown by X E Y F, Fig. 96. It will be noticed that X of the pattern for the side in Fig. 96 joins X′ and X′ on either side of the pattern for the front in Fig. 96, the joining being shown at X^2 X^2, Fig. 97. Then will B A B, Fig. 97, be the desired pattern for the front and two sides

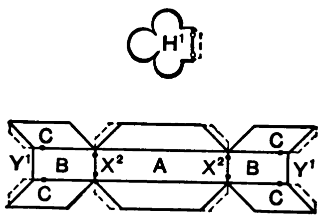


Fig. 97.—Joining in One Piece the Pattern for Front and Sides of Covering; also Pattern for Leaf.

of the covering. Laps are allowed as shown by the dotted lines in Fig. 97.

For the pattern of the strip which bounds the leaf H, front view, Fig. 96, proceed as follows: At right angles to C D of the pattern, Fig. 96, draw the lines 3 and 4 indefinitely to the right, as shown by 3 K and 4 L. It should be understood that the width 3 4 of the pattern on the line C D, Fig. 96, is the same as the width 3 4 of the section, and is the width of the strip which bounds the figure H in front view, as shown by S S^2 in plan view. From the bend G in plan view, which corresponds to the angle 1 and 14 of the leaf H in front view, drop a perpendicular line cutting the lines I K and J L, as shown at 1′ of the pattern. Now space the leaf H, front view, Fig. 96, into an equal number of parts, as shown by the small figures from 0 to 14; transfer the space with

the dividers from 0 to 4, front view, on the lines I K and J L, from 1′ to 2′. Now transfer the spaces from 4 to 10, front view, to the pattern, as shown from 2′ to 3′; then again transfer the spaces from 10 to 14, front view, to the pattern, as shown from 3′ to 4′. Now place a duplicate of the miter 1′ J I, Fig. 96, as shown at 4′, L and K, which completes the pattern. Then will I J L K be the pattern for the strip bounding the leaf H, front view, Fig. 96. The miter I J will be cut away from the pattern of the front, as shown. The leaf H′, shown in Fig. 97, is a duplicate of the leaf

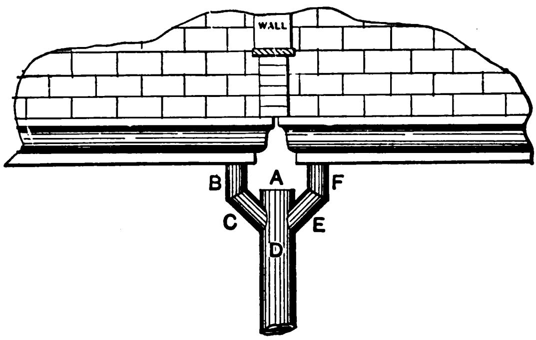


Fig. 98.—Method of Connecting Two Molded Eave Troughs by Means of a Y-Branch

H, front view, Fig. 96. A lap is allowed at H′, Fig. 97, which is bent at right angles and soldered to Y′ Y′, Fig. 97.

BENDING THE COVERING.

If a bar folder is at hand, the pattern shown in Fig. 97 could be bent upon the two lines C C and C C, after which the cross bends could be bent by hand, as shown by X^2 X^2, Fig. 97, and soldered to their required angles. If a folder is not at hand the pattern B A B, including the leaf H′, Fig. 97, and the strip for the leaf shown by I J L K, in Fig. 96, could be bent upon the hatchet stake previously shown in Fig. 6.

PATTERNS FOR BRANCHES AND JOINTS.

In Fig. 98 is shown the method of connecting two molded eave troughs with one leader by means of a Y-branch. It will be no-

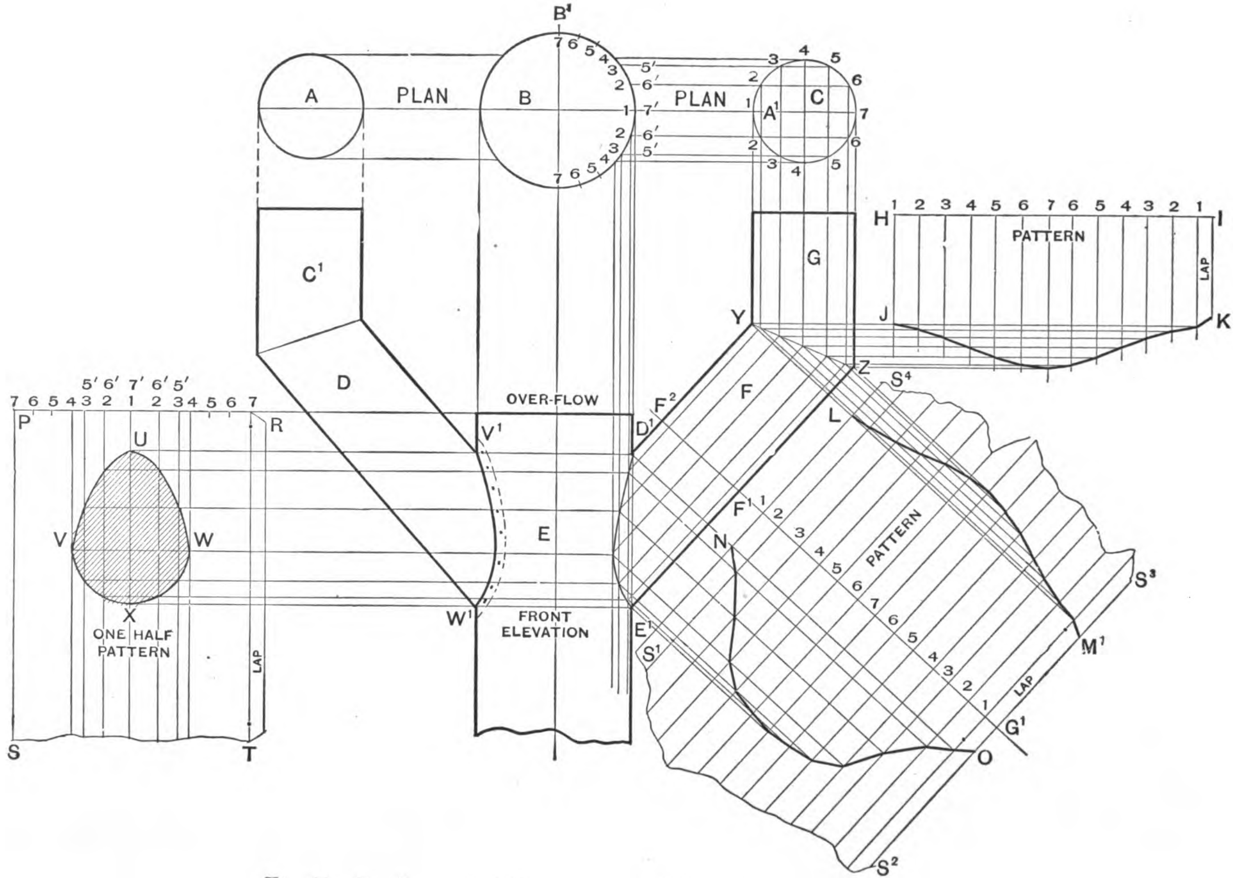


Fig. 99.—Development of Pattern for a Y-Branch Made of Round Pipe.

ticed by referring to the front elevation, Fig. 98, that the leader D runs slightly above the miter joints of the Y, as at A, which can be left open, and serve as an overflow in case of the sewer or leader stopping up, or in case the leader is frozen tight at the bottom.

The method of obtaining the patterns for the Y is shown in Fig. 99. The first step is to draw correctly the plan and elevation of the Y-branch, having them in their relative position to each other, as shown in Fig. 99.

Let C^1 D E F G, Fig. 99, represent a front elevation of a Y-branch, corresponding to any given angle, shown by B C D E F, Fig. 98, and let B, Fig. 99, be the plan view of the larger pipe and A and C the plan views of the two smaller pipes. It will be noticed that the angles of the Y, as shown by C^1 D E and E F G, are both alike, and therefore only one set of patterns is required. It will be noticed that the smaller pipe C, Fig. 99, abuts against the larger pipe B in plan, the centers being in one line. Now if the center points of the pipes were placed to one side of each other, the principles used in obtaining the patterns would still be the same. To obtain the pattern for the Y-branch, as shown by the plan and elevation in Fig. 99, proceed as follows: Divide the smaller pipe C in plan into any number of parts, as shown by the small figures, and have the seam to be placed as shown at A^1. Now at right angles to the line E B^1, Fig. 99, draw lines from the small figures on the circle C, intersecting the larger circle or center leader B, as shown by the intersections 4, 3 5′, 2 6′ and 1 7′, etc., corresponding in number to 4, 3 5, 2 6 and 1 7, etc., of the smaller circle C. Parallel to the line B^1 E drop lines indefinitely from the intersections on the plan B, as shown. Now from the spaces obtained on the plan C, Fig. 99, drop lines parallel to B^1 E intersecting the miter line of the elevation Y Z. From the intersections obtained upon the miter line Y Z draw lines parallel to the lines of the pipe Y D^1 or Z E^1, intersecting the perpendicular lines of corresponding numbers dropped from the intersections on the plan B. A line traced through these intersections, as shown from D^1 to E^1, will be the required miter line from which to obtain the measuring points for the pattern. For the pattern for that part of elbow shown at G, proceed as follows: At right angles to B^1 E draw the

stretchout line H I, upon which place the stretchout of the smaller pipe C, as shown by the small figures on the line H I. Now at right angles to H I, or parallel to B^1 E, drop lines indefinitely from the small figures, as shown, which intersect with lines of corresponding numbers drawn parallel to H I from the miter line Y Z. A line traced through these intersections, as shown from J to K, will be the required miter cut; or H J I K will be the required pattern for that part of elbow shown at G, Fig. 99. A lap is allowed for riveting, as shown. To obtain the pattern for that part of the elbow shown at F, and intersecting the larger pipe E, proceed as follows: At right angle to the line of the pipe E^1 Z draw the stretchout line, as shown by F^1 G^1, upon which place the stretchout of the smaller circle C, shown in plan view, as indicated by the small figures on the stretchout line F^1 G^1.

At right angles to F^1 G^1 draw lines indefinitely through the small figures on the stretchout line, as shown, which intersect with lines of corresponding numbers drawn at right angles to E^1 Z from the miter line Y Z at the top, and from the miter line forming the intersection of the two pipes shown by D^1 E^1 at the bottom. A line traced through these points, as shown from N to O and M to L, will be the required pattern for that portion of the elbow shown at F in front elevation, Fig. 99. In obtaining patterns of this kind it is not always convenient to obtain them with the use of the T-square, as just described. In shop practice the stretchout line is placed directly upon the sheet metal, the measurements being taken from the elevation and placed thereon by means of the compasses or dividers.

To illustrate: Let S^1 S^2 S^3 S^4, in Fig. 99, represent a piece of sheet iron upon which is drawn the stretchout line, as shown from F^1 to G^1, and through the small figures thereon the usual measuring lines are drawn. Extend the stretchout line G^1 F^1 as shown to F^2. Now measure the distance from the line F^1 F^2 to where the line 1 cuts the miter line Y Z, and transfer the distance to the sheet metal on the lines 1 1, measuring from the line F^1 G^1.

Then again measure the distance of the line 2, commencing on the line F^1 F^2 in elevation, to where line 2 intersects the miter line Y Z, and transfer this distance upon the line 2 2 on the sheet metal, measuring from the line F^1 G^1. In this way all the points

will be transferred to the sheet metal, thus completing the pattern N O M L, as shown in Fig. 99. A lap for riveting is allowed, as shown.

To obtain the pattern for the opening D^1 E^1, Fig. 99, proceed as follows: At right angles to B^1 E draw the line P R indefinitely, upon which place one-half of the stretchout of the larger circle B, as shown by the small figures from 7 to 7 on the stretchout line P R. It will be noticed, by referring to the plan, that the spaces 1 and 7 of the smaller pipe C intersect the larger pipe B on one line, and are indicated on the profile B, as shown by 1 7′. In the same manner do the spaces 2 6 and 2 6 and 3 5 and 3 5 of the circle C intersect the larger circle B on separate lines, and are indicated on the profile B by 2 6′, 2 6′ and 3 5′, 3 5′ respectively. Therefore are the figures 5′, 6′, 7′, 6′, 5′ placed over the figures 3, 2, 1, 2, 3 on the stretchout P R, corresponding to the numbered spaces on the profile B in plan. Now at right angles to the stretchout line, and through as many points in the stretchout as correspond to the points of the smaller pipe C, intersecting the larger pipe B, as shown in plan, drop lines from the stretchout P R, as shown, which intersect with lines of corresponding numbers drawn at right angles to B^1 E or parallel to P R from the miter line D^1 E^1. A line traced through these intersections, as shown by U V X W, will be the required opening to be cut in the larger pipe B, and on to which the pipe F shown in front elevation will miter. At V^1 W^1 in Fig. 99 is shown the method of putting a flange on the elbow C^1 D, placing the flange on the inside of the larger pipe E, either soldering or riveting, as shown.

It will be noticed that P R S T in Fig. 99 represents but one-half of the larger pipe B, as shown in plan. After the half pattern is completed, as shown, and the opening U V X W cut out, turn over the pattern on the line P S and trace the pattern on the other side, including the opening U V X W, omitting the lap shown from T to R, which will then be the complete pattern desired.

PATTERNS FOR T-JOINTS, SQUARE PIPES.

In Fig. 100 is shown the method of connecting two eave troughs into one leader by means of a T-joint. In Fig. 101 is

shown the plan and elevation of a T-joint, the section of the pipe being square, also the method of obtaining the patterns.

Let B C D E G F, Fig. 101, represent the front elevation of a T-joint made to any given angle, shown by A B C, Fig. 100. Let W represent the plan view of the larger pipe and X the plan view of the smaller pipe; draw the plan and elevation in their proper relative position and let the seam be placed at A^1 in plan for the larger pipe W and at A in plan for the smaller pipe X.

Now at right angles to A^1 A^2 in the plan, Fig. 101, draw lines from the corners of the profile X, cutting the side of the profile W, as shown at 1 4 and 2 3, corresponding to the figures on the corners of the smaller pipe or profile X.

As the seam is to be placed at A in the profile X, plan view, as before explained, it will be necessary to obtain this point in eleva-

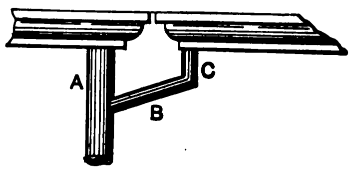


Fig. 100.—Method of Connecting Two Eave Troughs with a Leader by Means of a T-Joint.

tion from which to obtain the line of the seam on the elbow patterns. Therefore parallel to A^1 Z, Fig. 101, drop a line from the seam A in the profile X, cutting the miter line H I in the elevation. From the intersection obtained on the miter line H I draw a line parallel to the line of the pipe I K, cutting the side of the larger pipe in elevation, as shown at J^1. To obtain the pattern for part of the elbow F proceed as follows: At right angles to A^1 Z draw the line A^2 A^2, upon which place the stretchout of the smaller pipe X in plan, commencing at the seam A, as shown by the small figures on the stretchout line A^2 A^2.

At right angles to A^2 A^2 draw lines indefinitely from the small figures in the stretchout, as shown, which intersect with lines of corresponding numbers drawn at right angles to A^1 Z, or the lines of the pipe, from the miter line H I. A line drawn through these

intersections, as shown, from P to R, will be the required pattern for one arm of the elbow shown at F. For the pattern of the arm of the elbow shown at G proceed as follows: At right angles to the lines of the pipe K I or J H, front elevation, Fig. 101, draw the stretchout line A^3 A^3 indefinitely, upon which place the stretchout of the

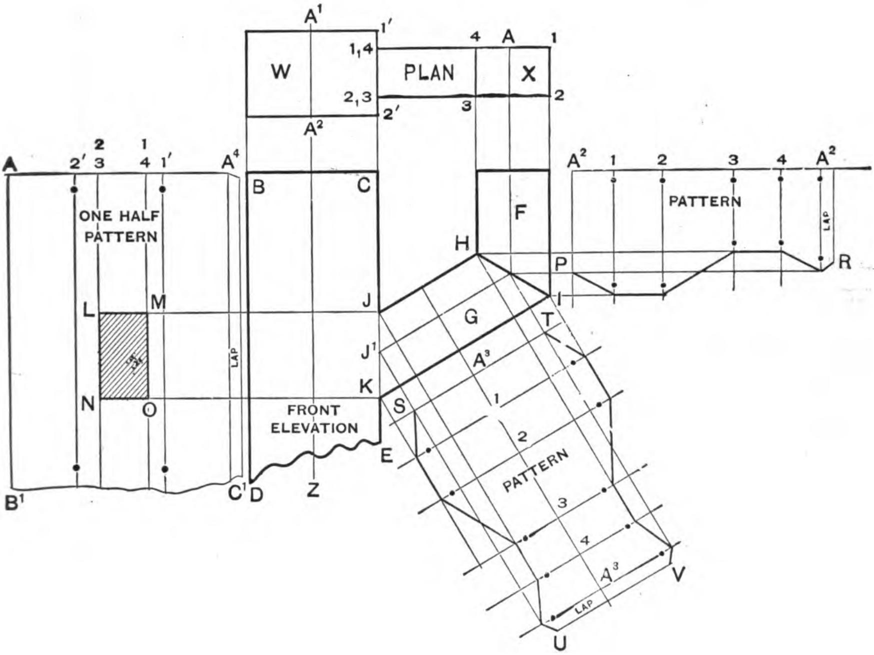


Fig. 101.—Development of Patterns for a T-Joint Made of Square Pipe.

smaller pipe X, shown in plan, commencing at the seam A, as shown by the small figures upon the stretchout line A^3 A^3. At right angles to A^3 A^3 and through the small figures draw lines indefinitely, as shown, which intersect with lines of corresponding numbers drawn at right angles to the lines of the pipe J H or K I from the miter line H I at the top, and J K at the bottom. A line drawn through these intersections, as shown by S U V T, will be the required pattern for the arm of the elbow shown at G. To obtain the size of the opening J K which will be cut on to the larger

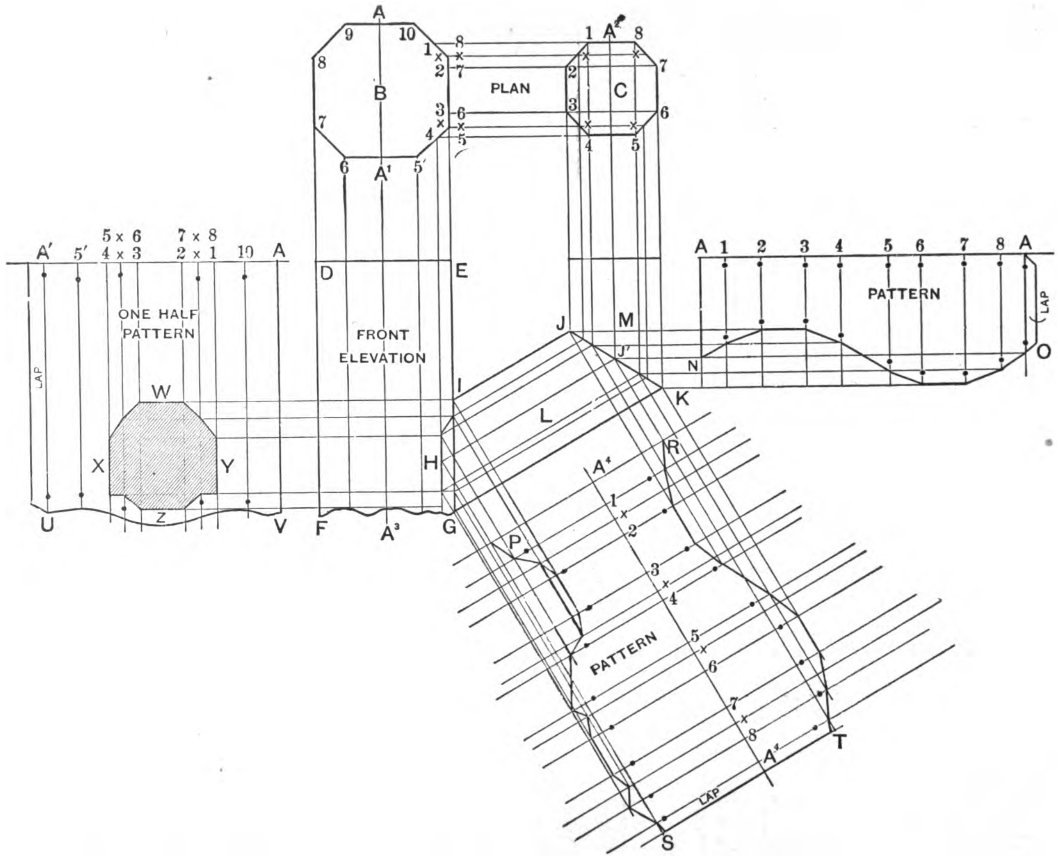


Fig. 102.—*Plan and Elevation of* T-*Joint in Octagon Pipes, With Method of Obtaining the Pattern.*

pipe shown by B C D E in elevation, Fig. 101, proceed as follows: At right angles to A^1 Z draw the stretchout line A^4 A^5, upon which place the stretchout of half of the profile W, shown in plan, commencing at the seam A^1, as shown by the small figures upon the stretchout line A^4 A^5, the numbers 3 2 and 4 1 on the stretchout A^4 A^5 corresponding to the numbers showing the intersections of the smaller pipe X on the side of the larger pipe W. At right angles to A^4 A^5 drop lines from the small figures, as shown, which intersect with lines of corresponding numbers drawn at right angles to the lines of the pipe B D or C E from the miter line J K, as shown. A line drawn through these intersections, as shown by L M N O, will be the opening required. A lap is allowed for riveting, as shown. It will be noticed that A^4 A^5 B^1 C^1 represents but one-half of the pattern of the larger pipe shown by W in plan. For the entire pattern simply turn over the half pattern on the line A^5 B^1, transferring the dots, as shown, which indicate the bends, and omitting the opening L M N O and the lap for riveting. It should be understood that by placing the elbow F G, Fig. 101, on the other side of the pipe D E C B, a Y-joint would be the result, the same as shown in Fig. 99, with the exception that the pipe is round in Fig. 99 and square in Fig. 101.

PATTERNS FOR T-JOINTS IN OCTAGON PIPES.

In Fig. 102 is shown the plan and elevation of a T-joint, also the method of obtaining the patterns, the section of the pipe being octagon. Let D E F G L M, Fig. 102, represent the front elevation of the T-joint in question, at any given angle, B, in plan view, the profile of the larger pipe, and C, in plan view, the profile of the smaller pipe. Care should be taken to draw the plan and elevation in their proper relation to each other. Let the seam in the larger pipe B be placed as shown at A, and let the seam in the smaller profile C be placed as shown at A^2, Fig. 102. Now at right angles to A A′ draw lines from the corners of the profile C intersecting the profile B, as shown at 1 8, 2 7, 3 6 and 4 5, corresponding to the figures on the corners of the smaller profile C, shown in plan view, Fig. 102. The next step is to obtain the intersections of the corners X X and X X of the larger profile B, upon

the smaller profile C. At right angles to A A′ draw lines from the corners X X and X X, intersecting the smaller profile C on the four sides, as shown by X, X, X and X. As the seam is to be placed at A^2 in the smaller pipe C, plan view, Fig. 102, as before explained it will be necessary to obtain this seam line in elevation so as to obtain the line of the seam on the elbow patterns. To do so and also to obtain the intersection of the smaller pipe against the larger pipe in elevation proceed as follows: From the intersections of the smaller pipe against the larger pipe in plan, Fig. 103, drop lines parallel to A A^3, as shown. Now parallel to A A^3 drop lines from the intersections and small figures, including the seam line on the smaller profile C in plan, until the lines intersect the miter line J K in elevation. Now parallel to the lines of the pipe J I or K G draw lines from the intersections on the miter line J K, intersecting lines drawn from corresponding figures on the profile B in plan view. A line traced through these intersections will be the miter line, showing the intersection of the smaller pipe with the larger pipe at the angle E I J, as shown by I H G. To obtain the pattern for part of the elbow M, shown on front elevation in Fig. 102, proceed as follows: At right angles to A A^3 draw the line A A, upon which place the stretchout of the smaller profile C, as shown by the small figures A, 1, 2, 3, etc., on the line A A.

It will be noticed that we have not transferred the intersections *x, x, x* and *x* on the profile C to the stretchout line A A, it not being necessary for this pattern. It will also be noticed that A A of the stretchout represents the seam A^2 of the profile C and that the seam line intersects the miter line J K at J^1 and the intersection of the larger pipe in elevation at H, all as shown in Fig. 102. Now at right angles to A A draw lines indefinitely, as shown, which intersect with lines of corresponding numbers drawn at right angles to A A^3, or parallel to the stretchout line A A, from the miter line J K. Short lines connecting the points of intersection, as shown by N O, will be the required pattern for that part of elbow indicated at M in the elevation. For the pattern of part of the elbow L, shown in elevation in Fig. 102, proceed as follows: At right angles to the lines of the pipe I J or G K draw the line A^4 A^4, upon which place the stretchout of the smaller pipe C, as shown in plan, Fig. 102, being careful to transfer the intersections

x, x, x and *x* to the stretchout A^4 A^4, as shown. At right angles to A^4 A^4 draw lines indefinitely through the small figures, which intersect with lines of corresponding numbers drawn at right angles to the lines of the pipe I J or K G from the miter line J K at the top and from the miter line I H G at the bottom.

A line traced through these intersections, as shown by P, S, T and R, will be the required pattern for that portion of the elbow shown at L, front elevation, in Fig. 102. It will be noticed that the lines *x x x x*, drawn at right angles to the stretchout line A^4 A^4 in Fig. 102, have not been used in developing the pattern of

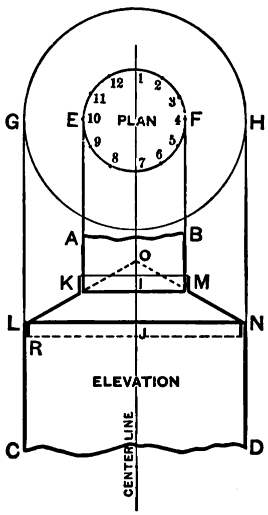


Fig.* 103.—*Joining a Small Round Pipe to a Larger One by Means of a Flaring Collar.

the pipe for the miter line J K, it not being necessary, because the cut R T is the same as the cut N O on the pattern for the pipe M, but they have been used in developing the pattern for the lower part of the pipe L, intersecting with points drawn from the miter line I H G in Fig. 102, as shown in the cut P S in pattern. To obtain the size of the opening which will be cut in the larger pipe D E F G, front elevation, Fig. 102, proceed as follows: At right angles to A A^3 draw the stretchout line A A^1, upon which place

one-half of the stretchout of the profile B, commencing at the seam A, as shown by the small figures on the stretchout line A A^1; the figures 5 4, *x x*, 6 3, 7 2, *x x*, and 8 1 corresponding to the numbers showing the intersections of the smaller pipe C against the larger pipe B in plan.

Now, at right angles to A A^1 drop lines from the stretchout line, which intersect with lines of corresponding numbers drawn at right angles to the lines of the pipe D F or E G, from the miter line I H G. A line drawn through these intersections, as shown by W X Z Y, will be the opening required. Laps are allowed for riveting on the three patterns, as shown in Fig. 102. It will be noticed that A^1 A U V represents but one-half of the pattern of the larger pipe. For the entire pattern simply turn over the half pattern on the line A V, transferring the dots, as shown, which indicate the bends, and omitting the opening W X Z Y and the lap for riveting. This completes the entire patterns required. Laps should be allowed on the miter cuts of all elbow patterns shown in this figure.

FLARING COLLARS FOR ROUND, RECTANGULAR AND OCTAGON PIPES.

It is often the case in putting up leader or other pipe work that a smaller pipe is connected to a larger one by means of a flaring collar or "reducer." The following sketches have been prepared, showing how to obtain the patterns, whether the pipe be round, square or octagon in plan. Let Fig. 103 represent the joining of a smaller pipe to a larger one by means of a flaring collar, the pipe being round. A B D C represents the elevation, E F the plan of the smaller pipe, and G H the plan of the larger pipe; I J the straight hight of the flare between the two pipes; the center point of the large and small pipe being the same. Connect the pipes as shown by L K and N M, and produce these two lines until they intersect the center line at O. Then will O be the center point and O M and O N the radii with which to strike the pattern.

Now, with O N, Fig. 103, as radius and O of Fig. 104 as center strike an arc, as shown by N A. Draw a line from N to O, as shown; then with O M, Fig. 103, as radius and O of Fig. 104 as center strike another arc, as shown, from M to B. Divide the plan E F, Fig. 103, into an equal number of spaces, and measure

off these spaces on the arc M B, Fig. 104, commencing on the line N O, as shown from M to B. Draw a line from the center point O through the point B, intersecting the arc A N, as shown at A. Allow a lap, as shown from A to B.

Then will A B M N, Fig. 104, be the pattern for the flaring collar, shown by M N L K in Fig. 103. In joining the collar to the pipes flanges would be allowed for riveting, as shown at R and K in Fig. 103. It will be noticed that the flanges K and R are so arranged as to correspond to the flow of the water. To obtain

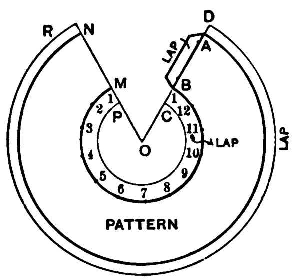


Fig. 104.—*Obtaining the Pattern for Flaring Collar Shown in Fig.* 103.

the flanges R and K upon the pattern, add their widths, as shown at R D in Fig. 104.

Now roll the pattern, shown in Fig. 104, on the blow horn stake, and rivet and solder same water tight. Next stretch the flange on pattern, shown at P C in Fig. 104, by means of a stretching hammer and a square stake, and draw in the bottom flange, shown at R D in Fig. 104, by running the flange through the turning machine, and then draw in the flange with the use of the mallet on the bottom stake. In Fig. 105 is shown the method used in joining a smaller pipe to a larger one, by means of a flaring collar, the pipe being rectangular in plan; also the method of obtaining the patterns. Let A B 1 2 C D E F represent the front elevation, K L M N the plan view of the larger pipe, and G H I J the plan view of the smaller pipe. To obtain the patterns for the flaring collar, shown by E F 1 2 on elevation, Fig. 105, proceed as follows: At right angles to E 2 of the elevation draw the line O P indefinitely, upon which place the stretchout of the flare, or slant

hight of the collar, shown by 1 2 or F E of the elevation. At right angles to O P draw lines through 1 and 2, as shown, which intersect with lines drawn at right angles to E 2 in elevation from the points 1, F and E, 2, as shown. A line traced through these intersections will be the required pattern for the front and back of the flaring collar. A lap is allowed, as shown by R S and T U, which is riveted to the two pipes when joining, bending the laps in the

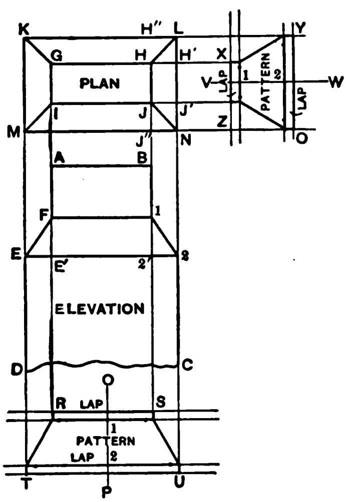


Fig. 105.—Joining a Small Rectangular Pipe to a Larger One by Means of a Flaring Collar; Also Method of Obtaining the Patterns.

same manner as shown in Fig. 103 at R and K. To obtain the pattern for the short side proceed as in the case just described.

It will be noticed that we have obtained the two patterns, one from the elevation and one from the plan, and that the miter cuts of these two patterns are alike. It should be understood that if the angles shown in plan by L N M or K M N were not right angles or square bends, the elevation could not be used for obtaining the pattern. But as the angles shown in plan, Fig. 105, are right angles, then for that reason can the patterns be obtained from plan and elevation as in this case, because the projection of the flare 2′ 2 of elevation, Fig. 105, is the same as the projection

of the flare shown in plan, as indicated by J J″ or J J′ or H H′ or H H″, for in obtaining the patterns, after having the stretchout, we have to deal with the projections only. In Fig. 106 is shown the method of joining a smaller pipe to a larger one by means of a flaring collar, the pipe being octagon. Let C D E F G H I J represent the elevation, L X O the plan view of the smaller pipe and M N the plan view of the larger pipe. It will be noticed that the plan view or pipe has alternate long and short sides. Before obtaining the pattern the first step is to obtain a diagonal section.

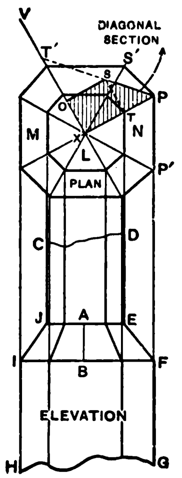


Fig. 106.—Joining a Small Octagon Pipe to a Larger One by Means of a Flaring Collar.

Let A B in elevation, Fig. 106, represent the straight hight of the flare, which place at right angle to one of the diagonal lines in plan, shown by X P. At right angles to X P draw X O equal in hight to A B of the elevation. Now where the line of the smaller pipe, shown by D E in elevation, intersects the diagonal or miter line X P in plan, as shown at T, draw a line from T at right angles to X P, equal in hight to A B of the elevation, as shown by T S in plan. Connect O and S and S and P, then will O S P X represent a section of the flare on the diagonal line X P in plan. Extend the line X O indefinitely, as shown by X V. Now

extend the line S P indefinitely until it intersects the line X V, as shown at T′. Then will T′ S and T′ P represent the lengths of the radii to be used in describing the pattern.

To obtain the pattern proceed as follows:

With T′ P of the diagonal section as radius strike an arc with O as center in Fig. 107, as shown from P to R; now with T′ S of the diagonal section in Fig. 106 as radius strike another arc from the same center, shown from S to T. Draw a line in the pattern from the center point O, as shown, from O to R, cutting the arc T S at T. Now take the distance of the short side S′ P, plan view, Fig. 106, and place it as shown from R to A on the pattern in Fig. 107. Then again, take the distance of the long side

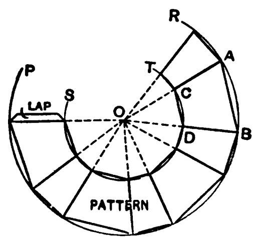


Fig. 107.—Pattern for the Flaring Collar Shown in Fig. 106.

P P′ in plan view, Fig. 106, and place it as shown from A to B on pattern in Fig. 107. In this way the short and long sides are placed upon the patterns alternately until the pattern is complete, having four short and four long sides. From the corners of the pattern shown by R A, etc., draw lines to the center point O, Fig. 107, which cut the arc T S at T C, etc. Draw lines from T to C and C to D, etc., which gives the widths of the sides of the smaller pipe shown in plan view in Fig. 106. The lines A C, B D, etc., represent the bends, which can be made on the hatchet stake. Laps are to be allowed for riveting in joining the large and small pipe to the collar, in the same manner as shown by K and R in Fig. 103. If desired the collar can be made in separate pieces by simply cutting on the lines A C or B D in pattern, Fig. 107, using as many as required.

SKYLIGHT CONSTRUCTION.

First Prize Essay.

By Henry M. Sanders.

PLATE I.—GROUND PLAN AND ELEVATION OF SKYLIGHT.*

Fig. 1, Plate I, is the ground plan and Fig. 2 is the elevation of skylight, the skylight being 4 feet wide and 6 feet long. The bars on all four sides are placed 12 inches on centers. In the construction herein set forth, the measurement of bars is on the curb line.

A represents the curb, B the hip bar, C, D, E and F the various side bars, which have the same form or shape, with the same miter at the curb, but with different miter developments at the top of bar. While all of these various bars, C, D, E and F, require miters at top and bottom, or curb, and as the curb miter is the same in all cases, we have only developed the curb miter for the bar C, on Plate V. Hence on those plates where we have developed miters for D, E and F we have only developed the top miter.

To obtain the length of hip bar *c b* draw the line *b k* at right angles with *b c* and make *b o* equal in length to hight of skylight, as shown by *f g* in elevation, Fig. 2. Draw lines from *c* to *o* and we have the length of hip bar B required, or in this case 36¾ inches. At point *e* on line *c b* draw dotted lines at right angles with *c b*, intersecting the line *c o* at *s*, or 18⅜ inches as the distance from bottom line of measurement of hip bar B to intersecting point at top of side bar E. The lengths of side bars C, D and F are all the same and as shown by *f h*, or 27¾ inches, in Fig. 2. The hight of skylight, as represented by *f g* in Fig. 2, is 13⅞ inches. The length of ridge bar G is 24 inches and the length of side bar E, as shown by *h m* in elevation, Fig. 2, is 13⅞ inches.

In cutting the glass for the skylight, cut it enough smaller than the space in the frame it is to occupy so as to allow about ⅛ inch space all around the glass.

In the development of miters as herein set forth I have applied a principle of development that it is believed will apply alike to any other form of bar or curb and to any other given pitch of skylight. While there is a great variety of bars and curbs in use,

*Note.—See end of book for Plates I, II and III.

the ones I have selected for the development of patterns, being without curves, make less confusion of intersecting lines, and, being made with sharp angles, the bars are easily made on most machines and brakes used by skylight and cornice makers.

The size of bar I have given I have found of sufficient strength to meet all the requirements of a skylight 4 x 6 feet, or of a similar size, on the pitch given. But as the skylight is increased materially in size we must also increase the size of bar and curb to suit the best construction. Very large skylights must have not only the bars increased in size, but a core plate inside of them to secure the proper strength and stiffness to the bar. Also a cap over the gutter of bar, as shown by *c c* in section of bar, Fig. 5, Plate II.

But in the size of bar I have used for a 4 x 6 foot skylight the use of the cap plate *c c* is not considered necessary, as the bar can be made sufficiently strong by being soldered at the point *d*, where the two sides of the bar come together, as shown in Figs. 1, 2 and 3 on Plate II.

PLATE II.—SECTIONAL VIEWS, FULL SIZE, OF THE CURB AND BARS USED.

On this plate we have represented the full size section of the various parts we have adopted in the construction of a skylight of this size and character. Fig. 1 represents the side bars, as shown on Plate I, Fig. 1, by C, D, E and F. Fig. 2, on this plate, is the ridge bar, Fig. 3 the hip bar and Fig. 4 the curb. B, in Fig. 4, is the full size section of wooden curb, on which the skylight is presumed to set, and A, in Fig. 4, is the iron curb or base of skylight, which turns down on the inside of wooden curb and is nailed to same at point H, thus avoiding the necessity of any nailing on the outside of curb.

At point *a* in bottom of gutter in metal curb A make a perforation of holes ¼ inch in diameter, placed at intervals of about 6 inches around the entire curb of skylight, for carrying off all condensation that may gather on the under side of the glass.

Fig. 5 represents sectional view, full size, of complete construction of bar when glazed. E represents the bar as shown in Fig. 1. F is the cap, C C the glass, D D the putty. G represents

the cleat that holds the cap F on the glass, being riveted to bar E at point H, and is passed up through the top of the cap F. That portion that passes up through the cap is split in the center and turned down on cap as shown, half on one side and half on the other. This cleat is made of copper ¾ inch wide and placed about 3 inches from the bottom of bar. The top ends of caps are soldered where they join each other and do not require cleats at top except the bar is longer, but in the ordinary size skylight the one cleat at the bottom is generally considered, I believe, sufficient. Fig. 6 shows how the curb may be secured to an angle iron frame. K is the angle iron and the curb is secured to the same by being turned down under the angle iron at L.

Fig. 7 shows one method of constructing the curb where it rests on top of a brick wall. M is the brick wall, I are iron rods built in the wall with nuts at top to securely fasten the board or plank J to the wall, and the metal curb is fastened to this board by means of nails, N N.

PLATE III.—PLAN OF TOP MITERS.

On this plate we have shown ground plan, full size, of the intersecting points or miters at top of the bars B, E, D and F.

In the top section, Fig. 1, we have simply shown the intersection of hip bars B B with ridge bar G; *a b c* represents the ground plan of miter desired. On this same ground plan we have shown top miter for the E bar, which is represented by *k l m*.

In the lower section, Fig. 2, the intersection of the hip bars B B with ridge bar G is represented by dotted lines, and the intersection of bars D D and F with hip bars and ridge is represented by solid lines; *d e f* shows the ground plan of miter for the bar D, and *e g h* the ground plan of the miter for the bar F.

We have made this distinction because in constructing the skylight and putting it together the hip bars B B are the first to be set in place in connection with the ridge bar G, and the bars D D and F are mitered into them.

PLATE IV.—DEVELOPMENT OF CURB AND RIDGE MITERS.

Fig. 1 represents a section of the curb or base to skylight. On line A B, which is drawn perpendicular to the base of curb, lay off

the stretchout of the curb, making the distance between points A 1, 1 2, 2 3, etc., equal in length to the same points as shown in Fig. 1. That is, make A 1 in line A B equal in length between points,

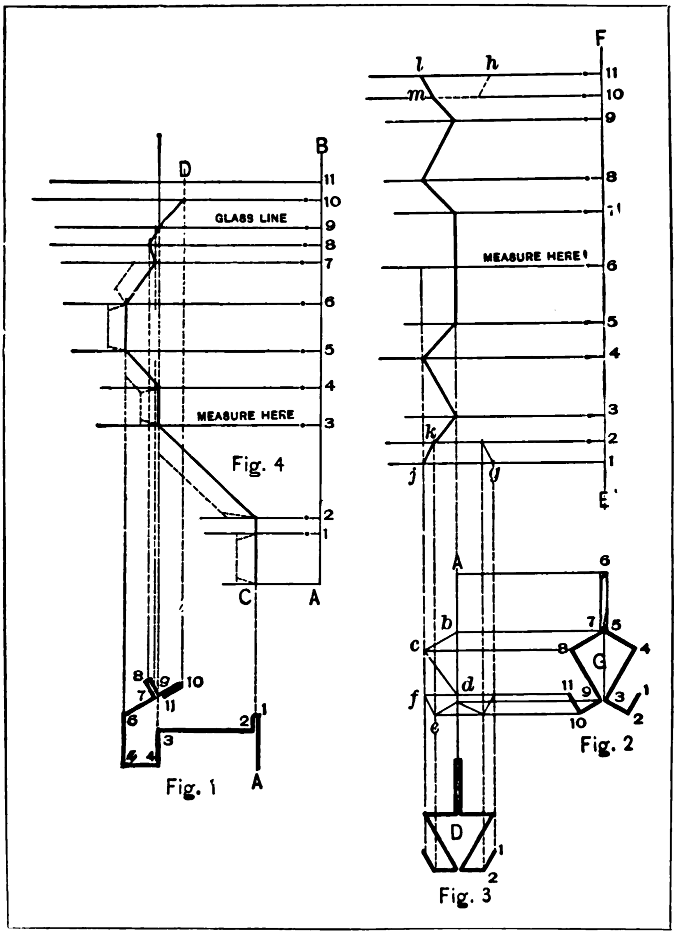


Plate IV.—Development of Curb and Ridge Miters. (One-Fourth Size.)

as between A 1 in Fig. 1, and the distance between 1 2 equal in length to the distance between corresponding numbers in Fig. 1, and thus continue the process until the full stretchout of curb is

obtained and laid off on the line A B. At these various points, A, 1, 2, 3, etc., thus obtained, draw lines at right angles with A B, intersecting the same with dotted lines drawn from corresponding figures in the curb, as shown in Fig. 1. Connecting these points of intersection with lines drawn between them, we have the miter of the curb C D. In laying off the full length of pattern of curb, mark off the distance between bars, both on the side and end pattern, with a prick mark on glass line, as shown in Fig. 1, in order to show where to set the bar in putting the frame together. In this case the distance between points is 12 inches.

Fig. 2 represents a section of the ridge bar G, showing end miter of same where it joins the hip bar B. Draw the line E F, at right angles with A 6 in Fig. 2. On the line E F lay off the points 1, 2, 3, 4, etc., equal in distance between points, as between the corresponding numbers 1, 2, 3, 4, etc., in section of ridge bar G, as shown in Fig. 2, thus giving us the stretchout of the bar. At these various points draw lines at right angles with E F, and intersect them with dotted lines drawn at right angles with A 6 in Fig. 2 from points A *b c d e f* where the ridge bar intersects with hip bar B.

In this skylight, as we have the side bar D intersecting at point A with bars G and B, it is necessary to cut away that portion of the pattern in Fig. 4 as shown by dotted lines *g j k* and *h l m*, in order that that portion of the gutter of the ridge bar, as shown in section by 1 2 and 10 11, may intersect and miter with the same points in side bar D in Fig. 3.

PLATE V.—PATTERN FOR SIDE BAR C.

Fig. 1 represents the elevation of the bar C, showing its connection with curb A at the bottom and ridge bar G at the top, and all its various points of intersection with same.

Draw line E F at right angles with pitch of bar, as shown in Fig. 1. On this line, E F, lay off the stretchout of the bar, as shown by the figures 1, 2, 3, etc., making the distance between 1 and 2, 2 and 3, etc., equal in length to the corresponding figures on section of bar C in Fig. 1. From these points, 1, 2, 3, etc., thus obtained on the line E F draw lines through them at right angles with E F, and of sufficient length on both sides of the line to be

intersected with dotted lines drawn at right angles with K L and from intersecting points at bar C with curb A and ridge bar G in Fig. 1.

Draw lines between the intersecting points of the dotted lines

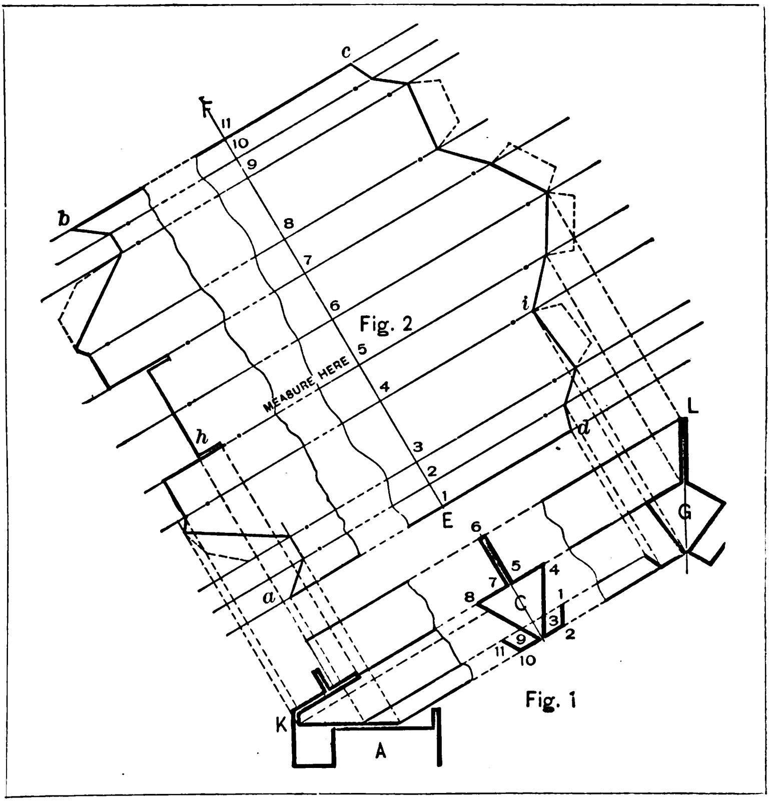


Plate V.—Pattern for Side Bar C. (One-Fourth Size.)

with the solid lines, drawn at right angles with E F, and we have *a b* as the development of the miter at the curb end of the bar, and *c d* as the development of the miter of the bar at the top where it intersects the ridge bar G.

PLATE VI.—DEVELOPMENT OF HIP BAR AND MITERS.

The development of the shape and form of the hip bar, and the intersecting points of the top and bottom miter to same.

Fig. 1 represents a portion of the skylight, showing the ground

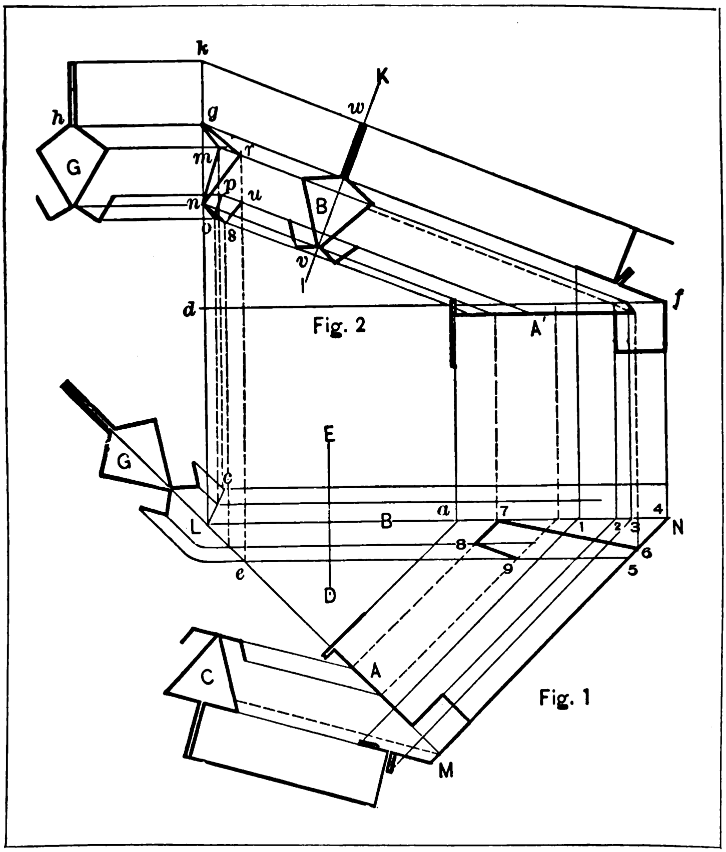


Plate VI.—Development of Hip Bar and Miters. (One-Fourth Size.)

plan and intersecting points of hip bar B at top with ridge bar G, and its connection at lower end with the curb. Let the angle L M N represent one-half of the end of the skylight. On the line L M

construct the curb A, with its front or gutter end resting on line M N.

With L M as the base line of curb construct the side rafter C, with its intersecting points at curb A, as already illustrated in Fig. 1, on Plate V.

At all points where the lines drawn from the angles in side bar C intersect with curb A draw lines parallel with M N, and continue them until they intersect with corresponding lines drawn from the angles of the ridge bar G. These lines thus drawn from the angles of the ridge bar, from their intersection with the hip bar B, are carried parallel with L N to their point of intersection at the curb with the lines drawn from the side bar C. Drawing lines between points, we have 1, 2, 3, 4, 5, 6, 7, 8, 9, representing one-half of the ground plan of the curb miter of the hip bar.

As Fig. 2 is to represent the elevation of the hip bar B with its intersecting points at the top of the ridge bar and at the bottom with the curb, to secure this we first lay off the angle *d f g*, corresponding with angle as shown by *b c o* in Fig. 1, Plate I.

On the base line *d f* of this angle *d f g*, which is drawn parallel with L N in Fig. 1, we construct the curb A′, which gives us the elevation of the curb on the miter line. The solid lines drawn to curb A′ from miter line *a* N on L N in Fig. 1, and at right angles with the same, show points of projection of the curb. The hight of curb at its various points is the same as corresponding points in curb A of Fig. 1.

The dotted lines drawn from 1, 2, 3, 4, etc., on this same line *a* N, and at right angles to it, and extended to curb A′ in Fig. 2, give us the different points of projection of the hip bar on the curb.

In order to secure the proper points in the miter at the top of the bar B, we will first continue the line *f g* until it shall intersect with a line drawn from the point L, and at right angles with L N in Fig. 1. Then at *g*, in Fig. 2, draw the line *g h* at right angles with *g d*, and at *h* construct a section at the ridge bar G. From the various angles of this bar thus obtained draw lines parallel to *h g* and intersect them with the dotted lines drawn from the miter *c* L in Fig. 1, and by connecting the points we have *k g m n o p* as the miter line in the elevation of the hip bar at the top. From

these various points thus obtained draw lines parallel to *g f* to the curb, when they will intersect points already secured from corresponding angles in side bar C in Fig. 1.

This gives us all the lines in the elevation of the bar. We are now prepared to construct a section, or shape, of the hip bar. But before doing so there is another top miter to be shown in the elevation of the hip bar B, which is *k g r n s u*. This is obtained by dotted lines drawn from the ground plan of the miter, as shown by L *e* in Fig. 1, at right angles with L N and intersecting corresponding lines in the elevation of the bar in Fig. 2, and by connecting the points it gives us, as stated, the miter line *k g r n s u*.

To construct the hip bar draw I K at right angles with *f g*, the pitch of bar. V W on line I K gives us the full hight of the bar and all intermediate lines crossing the line I K give us the hight of the bar at the various angles. The width of bar is shown at D E in Fig. 1. To construct the shape of the bar we simply make the width of the bar at the various points on line I K correspond with the width of same as shown on lines between D E in Fig. 1, or as shown by width of ridge bar G at its various angles.

PLATE VII.—PATTERN OF HIP BAR.

Fig. 1 represents the elevation of hip bar B, showing top or ridge miter and bottom or curb miter, as already developed in Fig. 2 on Plate VI.

To secure the pattern of this bar, first draw line A C from point A in top of elevation, Fig. 1, and at right angles with A B, the pitch of the bar, and on this line lay off the stretchout of the bar.

Make the distance between points *a, b, c, d* and *e* on line A C in Fig. 2 correspond in length to the same distance between *a, b, c, d* and *e* as shown in section B on Fig. 1, and we have *a k* on line A C as the full width, or stretchout, of pattern required.

From these various points of the stretchout of the bar thus obtained draw lines at right angles with the line A C, and of sufficient length to be intersected with dotted lines drawn at right angles with A B and from points in the top and curb miter, as shown in Fig. 1.

Connecting the points thus obtained, we have E F as the devel-

oped pattern for the top or ridge miter, and G H as the development of the lower, or curb, miter pattern.

The measure for the length of the hip bar is to be taken on the glass, or curb line, as shown on pattern by *o s*, Fig. 2, and equal in

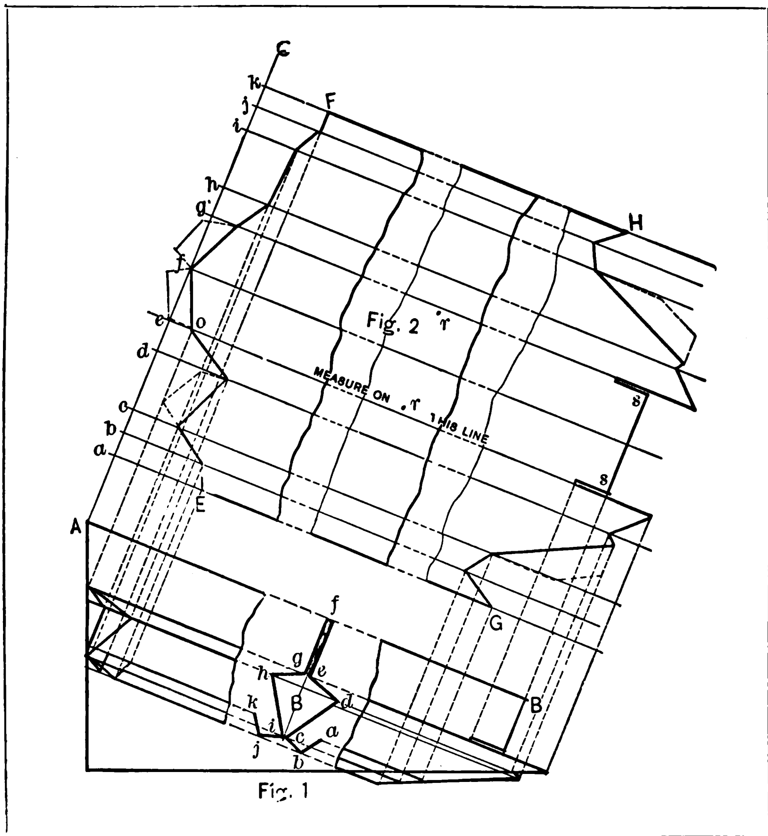


Plate VII.—Pattern of Hip Bar. (*One-Fourth Size.*)

distance from *c* to *o*, as shown in Fig. 1, Plate I; *r r* on pattern, Fig. 2, show points to be marked on pattern of intersection of side bar E at the top, as shown at *e* in Fig. 1 on Plate I. Hence the distance *s r* on the pattern, Fig. 2, is the same as *c s* on line *c o* in Fig. 1, Plate I.

PLATE VIII.—TOP MITERS FOR D AND F BAR.

Fig. 1 shows the ground plan and Fig. 2 the elevation of the miter. Starting with the ground plan and taking *e f* as the level line, we lay off the line *i g* at convenient distance from it and on

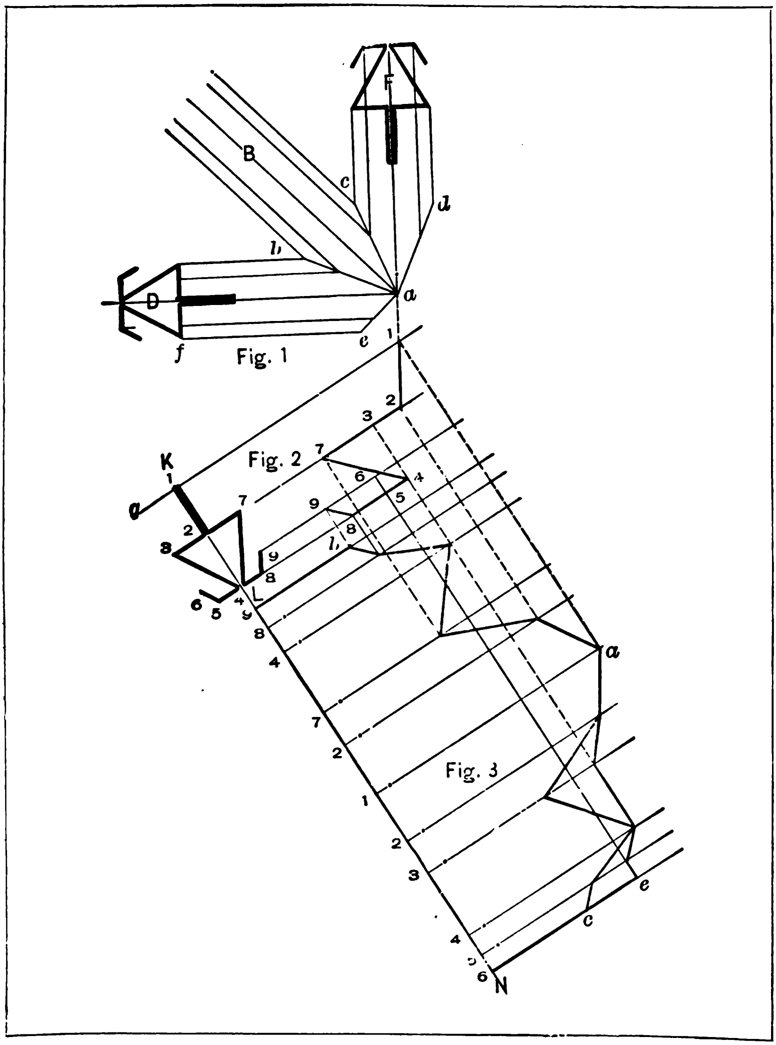


Plate VIII.—Top Miters for D and F Bar. (One-Fourth Size.)

the pitch of skylight, as shown by *f h* in Fig. 2, Plate I. Draw *k l* at right angles with *i g*. Construct the elevation of the bar D. At the various angles of the bar thus obtained draw lines parallel to *i g*, intersecting them at top with dotted lines drawn at right angles with *e f* in Fig. 1, and from points on the ground plan miter, as shown by *e a b*, said points in ground plan having been established by lines drawn from the angles in the section of bar D, in Fig. 1. Connecting the points thus obtained in Fig. 2 we have 1 2 3 4 5 6 as the form of miter in elevation, of which *e a* in Fig. 1 is the ground plan, and 1 2 7 4 8 9 is the elevation of the miter of which *a b* in Fig. 1 is the ground plan. As *a c* and *a d* represent the same miter in the ground plan as *b a*, the same elevation of the miter applies alike to all, so that the elevation of miter 1 2 7 4 8 9, developed from the ground plan *a b*, will be the same for *a c* and *a d*.

Having procured the form of the miter in elevation we proceed to lay off the miter. Draw line L N at right angles with *i g*, and proceed to lay off the stretchout of the bar, making all distances between points 9, 8, 4, 7, etc., on line L N in Fig. 3 to correspond to distance between same points 9, 8, 4, 7, etc., as shown in section of bar D in Fig. 2. From these points on line L N, and at right angles to it, draw lines parallel with *i g* of sufficient length to intersect the dotted lines drawn at right angles to *i g*. in Fig. 2, and from the points in the elevation of the miter 1, 2, 3, 4, etc., and we have *b a e* in Fig. 3 as the developed miter of the D mold, as shown in ground plan *b a e* in Fig. 1. As *a b* is the same as *a c* and *a d*, *b a c* in Fig. 3 is the developed miter for the bar F, as shown by ground plan *c a d* in Fig. 1.

Use the same curb miter for these bars D and F as already developed for bar C on Plate V.

PLATE IX.—TOP MITER FOR THE E BAR.

In Fig. 1 we have reproduced that portion of Fig. 1 in Plate III which shows the intersection in ground plan of the bar E with the hip bar B; *a b c* on plan presents the miter. Draw lines from all the angles in bar E, and parallel with *c h*, to the miter line *a b* and *b c*, as shown. Having thus secured all of the points of intersection of the miter on the ground plan *a b c*, we proceed to de-

velop these intersecting points of the miter in the elevation of the bar, the same as for bars D and F on Plate VIII.

With *c h* as a level line lay off the line *i g* at a convenient dis-

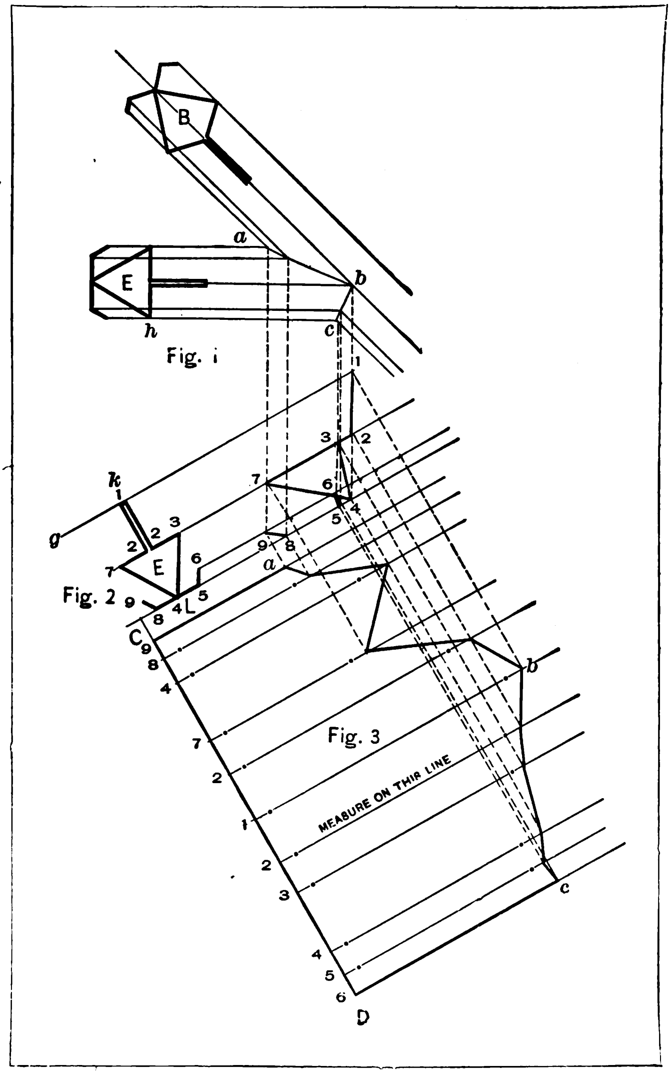


Plate IX.—Top Miter for the E Mold. (One-four h Size.)

tance from it and on pitch of skylight, as shown by *f h* in Fig. 2 on Plate I.

At point *k* on line *i g* in Fig. 2 draw *k l* at right angles with it. On this line *k l* construct a section of the elevation of the bar. Through the various points or angles on this bar, E, draw lines parallel to the line *i g* and of sufficient length so that they can be intersected, with dotted lines drawn at right angles with *c h* in Fig. 1, said dotted lines to be drawn from the various intersecting points on the ground plan *a b c* of the miter. Connecting the points we have, in Fig. 2, 1 2 3 4 5 6 as the elevation of the miter for which *b c* in Fig. 1 is the ground plan. 1 2 7 4 8 9 is the elevation of the miter of which *a b* in Fig. 1 is the ground plan. From this elevation of the miter we proceed to lay off the pattern. Draw C D at right angles with *i g*, and on this line lay lay off the stretch-out of the bar, making all distances between 9, 8, 4, 7, etc., on line C D in Fig. 3, to correspond in length with the same points 9 8 4 7, etc., as shown in section of bar E in Fig. 2. From each of these points, 9, 8, 4, 7, etc., in Fig. 3, draw lines at right angles to C D, and of sufficient length to intersect with the dotted lines drawn at right angles with *i g* in Fig. 2 and from the various points in the elevation of the miter. Draw lines between points of intersection thus obtained and we have *a b c* in Fig. 3 as the developed pattern of the miter. The lower or curb miter of this bar is the same as that already developed for the bar C on Plate V.

PLATE X.—DEVELOPMENT OF CAP MITERS.

Development of cap miters at points of intersection at top, the lower or bottom end of cap being cut square end.

The ground plan of the caps for the various bars, as shown in Fig. 1 and Fig. 2, are the same as for the bars, being the same in width. The full size and form of the caps for the various bars are already indicated on Figs. 1, 2 and 3, Plate II. E, B, D and F in Fig. 1 and Fig. 2 give the shape or section of cap for the various bars as the letters indicate.

E, as shown in Fig. 1, is the cap for the E bar that intersects and miters the cap for the hip bar B at the points *a, b, c*. The method of securing the pattern of this cap is the same as that of securing the pattern of the E bar, by dropping dotted lines from

this miter *a b c* at right angles with *o c,* until they intersect solid lines drawn from E′, the elevation of the cap on the pitch of the

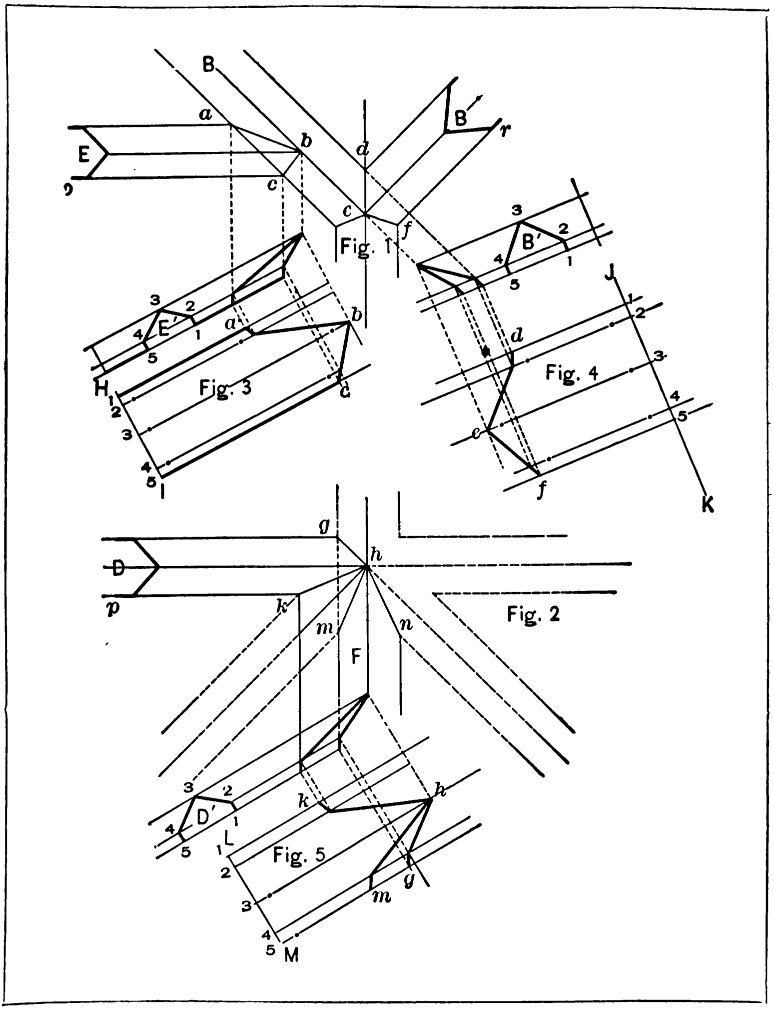


Plate X.—Development of Cap Miters. (*One-fourth Size.*)

skylight. This gives us points of projection of the miter in the elevation E′ from which to develop the pattern of the cap. First

draw the line H I at right angles with the pitch of cap E′ and on this line lay off the stretchout of the cap, making the distance between points 1, 2, 3, 4, 5 on line H I equal in length to 1, 2, 3, 4, 5 on section of cap E′. From these various points and at right angles to H I draw lines of sufficient length to intersect dotted lines from points of projection of miter in the elevation, and by connecting the points we have *a b c* in Fig. 3 as the developed pattern for the cap for the E bar.

The pattern for the cap for the hip bar B is obtained in practically the same way as the cap for all the other bars, with the exception that the pitch or elevation of the cap, instead of being the same angle, is as we have already shown and explained by *c o* in Fig. 1, Plate I. But the base line of the pitch or elevation of this cap is parallel with the line *f r* in ground plan B. On this angle construct the pitch or elevation of the cap B′, drawing lines through the various angles of this cap parallel with the pitch of same and intersect them with dotted lines drawn at right angles with *f r* in ground plan and from points *d e f* of miter. At right angles with elevation B′ draw the line J K, and on this side construct the stretchout of the cap, making the distances between the points 1, 2, 3, 4, 5 on this line J K the same as between corresponding points 1, 2, 3, 4, 5 in section B′. From these points draw lines at right angles to J K and intersect them with dotted lines drawn from miter points already obtained in the elevation. Connecting the points, we have *d e f* in Fig. 4 as the developed pattern.

In Fig. 2 we have the intersecting miters of the D and F cap with the hip and ridge; *g h k* is the ground plan of the miter for the D cap and *m h n* the ground plan of the miter for the F cap.

Construct the elevation of the cap D′ the same as for the cap E, drawing lines through the angle of section D′ in elevation and parallel with pitch or elevation, and intersect them with dotted lines drawn at right angles with *p k* in ground plan and from the intersecting points or miter *g h k*. Connecting the points, we have the projection of the miter in the elevation. We next draw the line L M at right angles with the pitch of cap D′, and on this line lay off the stretchout of the cap, as shown by 1, 2, 3, 4, 5 in section of D′, making 1, 2, 3, 4, 5 on line L M the same distance between points, thus giving the full width of the pattern required.

From these various points draw lines at right angles with L M and intersect them with dotted lines drawn at right angles with pitch of cap and from points established in the elevation of the miter. Connect the points and we have *k h g* in Fig. 5 as the developed pattern for the D cap.

As the angle *h m* and *h n* in cap F are the same as *h k* in cap D, we make *h m* the same as *h k* in Fig. 5, or *k h m* as the pattern for the F cap miter ***h m n.***

Second Prize Essay.

By John C. Dressel.

MAKING A SKYLIGHT.

In making a metallic skylight, the mechanic has the same general problems to contend with that a carpenter has in constructing a hipped roof and laying out the various rafters for the same. The carpenter has a plate or foundation to start with, and the different rafters, which he terms the common rafter, hip rafter and jack rafter. So in constructing a skylight we will be compelled to impose on some of our carpenter friends' good nature and borrow a few of his familiar terms. Instead of using his plate we have substituted the word "curb," which will be the foundation for starting to build a skylight. Instead of using his rafters we will use bars, hence we have common, hip and jack bars.

The Metal Worker did not require a ventilator skylight, but as skylights are for the purpose of giving light in dark quarters, as dark places usually accumulate moisture, and moist places disease, there is a necessity for ventilation. We have, therefore, submitted plans and patterns for a ventilated skylight, as the same general steps are necessary to produce a light with a plain ridge as a light with a ventilator.

Let Fig. 1 be the plan of a skylight which it is desired to build.

Fig. 2 represents a sectional elevation of Fig. 1 on line A B, the pitch of the light in this case being one-third pitch.

Fig. 3 shows profile of curb bar. It will be noticed by inspection that it is formed of one piece of metal and of such a shape as to form a trough.

The various bars are attached to this curb in such a manner that all condensation will empty into this trough. By punching holes where marked in Fig. 3 the water is allowed to escape to the outside of curb. These holes should be so punched as not to come directly opposite each other, and be about ½ or ¾ inch in diameter, and should furthermore be punched before the metal is formed up. Also punch holes about ¼ inch in diameter at A to allow the escape of any water that may accumulate under the glass. These

holes can be punched after the light is made up. The projection B is not really necessary, but it will be found an improvement, as it will throw the water out from the bulkhead underneath it. The

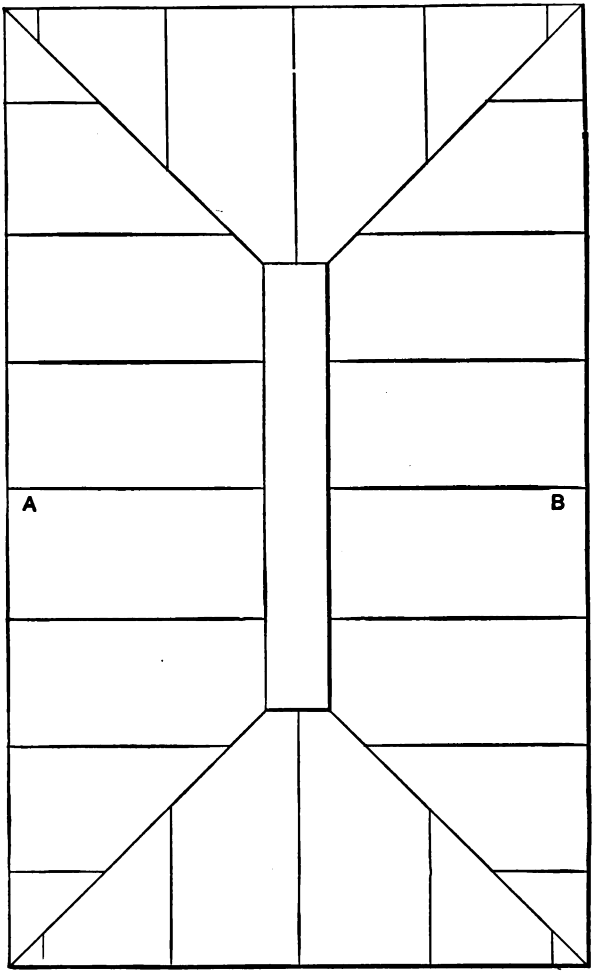


Fig. 1.

manner of securing skylight to bulkhead is also indicated in Fig. 3.

Fig. 4 represents broken elevation of curb.

Fig. 5 shows profile of one of the common and jack bars. A

B represents copper clip to be used in securing caps after the glass is in. The copper clip is made of sheet copper, about 14 or 16 ounces, and cut about 1½ x 2½ inches in size. The number of clips necessary to each bar is left to the option of the mechanic and as the case may require. Punch a hole, using a ½ or ⅝ inch chisel for the purpose, lengthways with the bar, and insert copper clip, as indicated by line A B, Fig. 5. By bending the ends of the copper clip toward each other and hammering flat it will have the appearance of Fig. 6.

We are now ready for the cap. Let Fig. 7 represent profile of

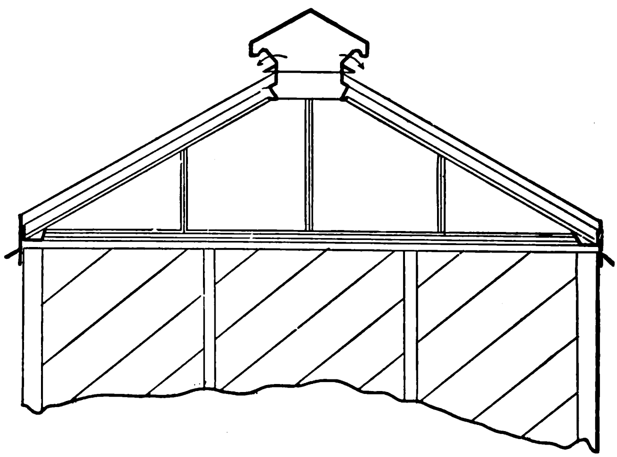


Fig. 2.

cap. Punch a hole, using same size of chisel as for bar, or large enough to allow copper clip to pass through. The hole is to be punched at C, Fig. 7, and after laying glass on bar and then putting on cap we have in general appearance Fig. 8, of which Fig. 9 is a broken elevation. A B, Figs. 8 and 9, should be bent down so as to hug close to cap. It will be readily seen that in case of breakage a new glass may at any time be easily inserted by simply straightening the copper clip A B and removing the cap.

FINDING LENGTH OF BARS.

We are now ready to start getting out the light. Let us first ascertain the length of the various bars. Let A B E S T D, Fig.

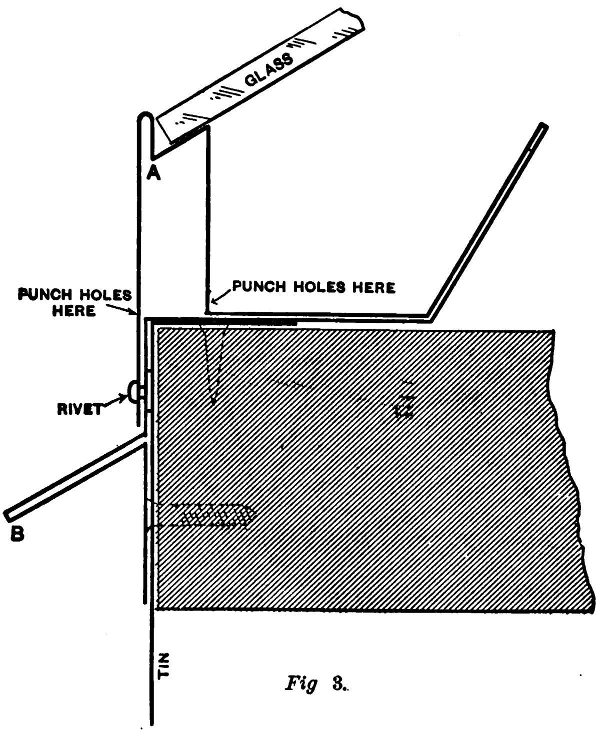


Fig 3.

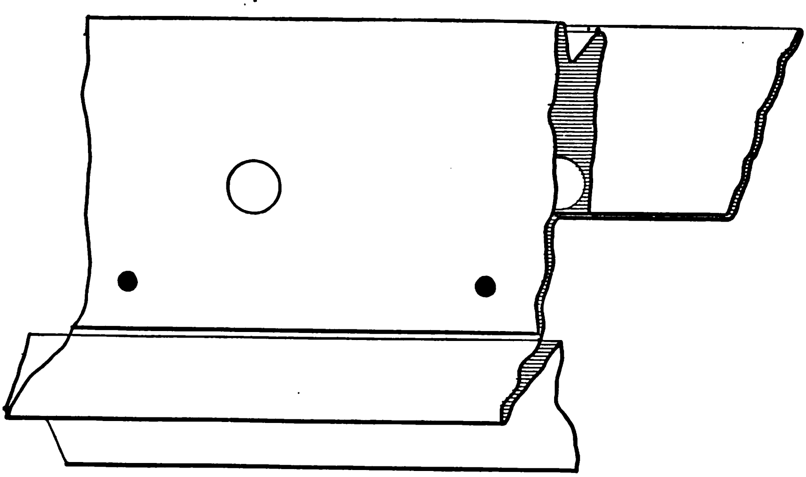
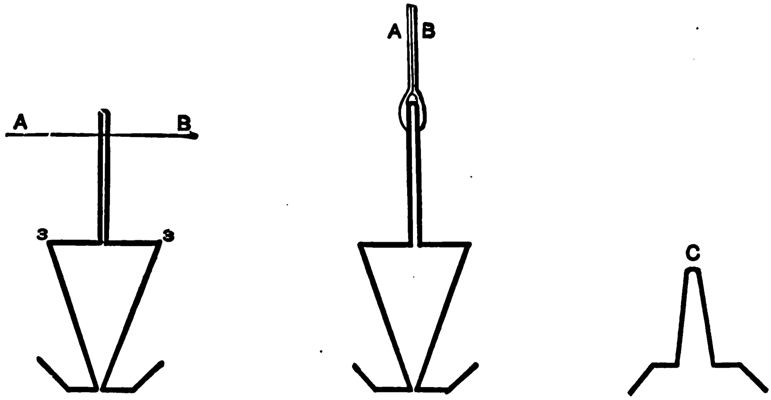


Fig. 4.

10, represent one quarter of plan, Fig. 1, enlarged for convenience sake. At right angles to line A B lay off dotted line, as shown. On this line lay off the desired hight or pitch you wish skylight, in



Figs. 5, 6 *and* 7.

this case one-third pitch, as at C. Then A C will be the length of the common bars. Let me here mention that all measures are taken on the glass line. At right angles to D E lay off dotted line, as shown at F, making the space E F the same as the space B C.

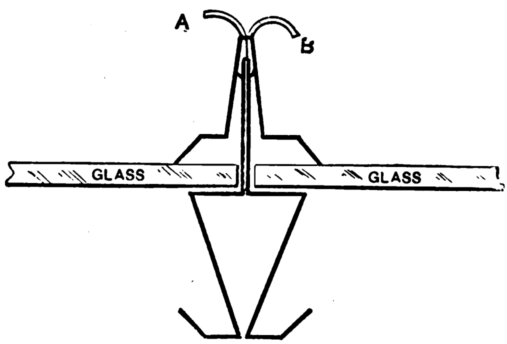


Fig. 8.

D F will therefore be the length of the hip bar. G H, J K, M N, P Q represent different jack bars, and H, K, N, Q where they intersect with hip bar.

At right angles to hip bar, line D E, lay off dotted lines from H, K, N, Q until they cut line D F, as shown at I′, L′, O′, R′. At right angles to G H lay off dotted line I. With space equal to H I′ lay off H I, establishing point I. G I will therefore be the length of one of the jack bars. The lengths of the others are obtained in the same manner—that is, laying off dotted lines at right angles to jack bars where they intersect with hip line D E, and making the space K L equal to K L′, and space N O equal to N O′,

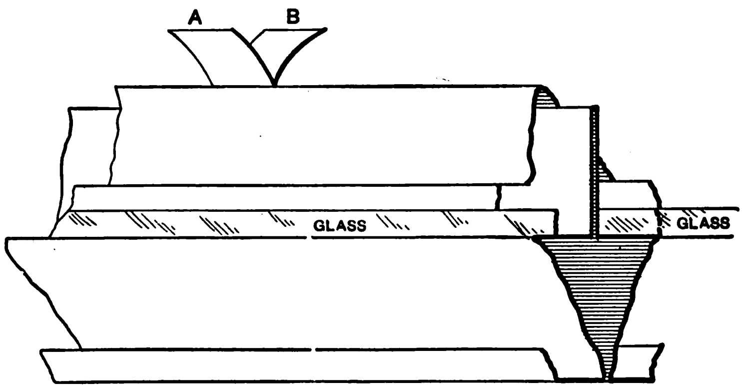


Fig. 9.

and space Q R equal to Q R′. J L will be the length of one, M O of another, and P R of another of the jack bars.

LAYING OUT PATTERN FOR CURB.

Having now established the different lengths of the various bars, we are ready to proceed with the laying out of the patterns. Let us begin with the curb or foundation, numbering the various points of curb as shown in elevation, Fig. 11. The next thing we want is a plan to obtain pattern from. At right angles to base line 5 6 drop perpendicular line 7. At right angles to line 7, at any convenient point, draw line 7′, as shown; also drop perpendicular line 3. Parallel to line 7′, and with space between 7′ and 3′ equal to space between lines 7 and 3, draw line 3′, as shown. Then a line drawn as A B through the points where lines 3, 3′ and 7, 7′ intersect will be the necessary miter line. Drop perpendicular lines 8 6,

9 10, 1, 2, 4, 5, 13, 11, 12, cutting miter line A B, as shown. At right angles to perpendicular line 3 of elevation lay off stretchout

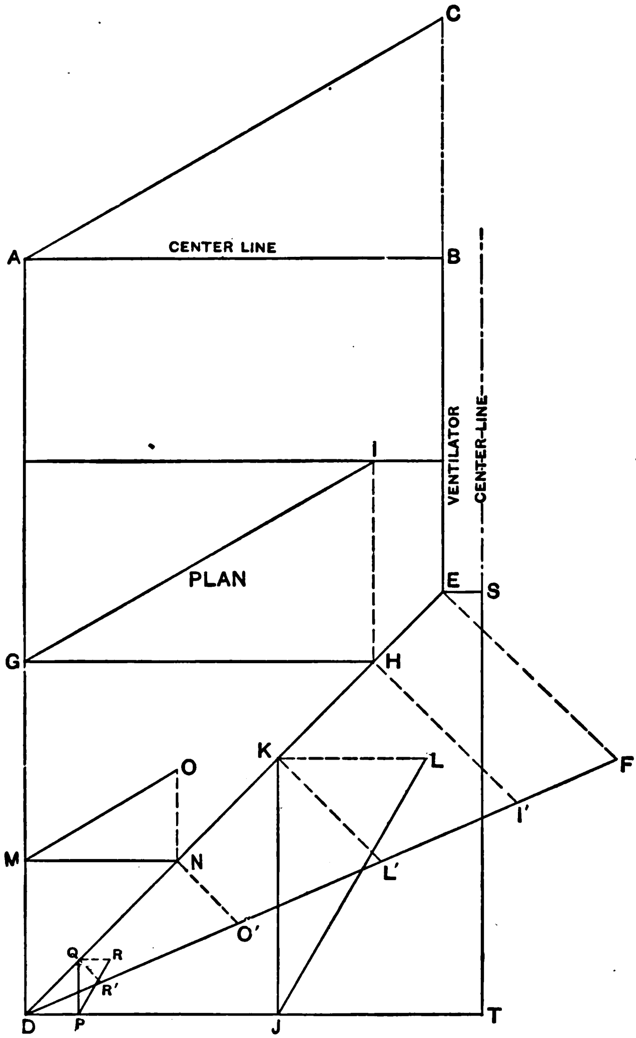


Fig. 10.

of curb (1 to 13), as shown. At right angles to stretchout line erect perpendicular lines, as shown in pattern. Parallel to stretch-

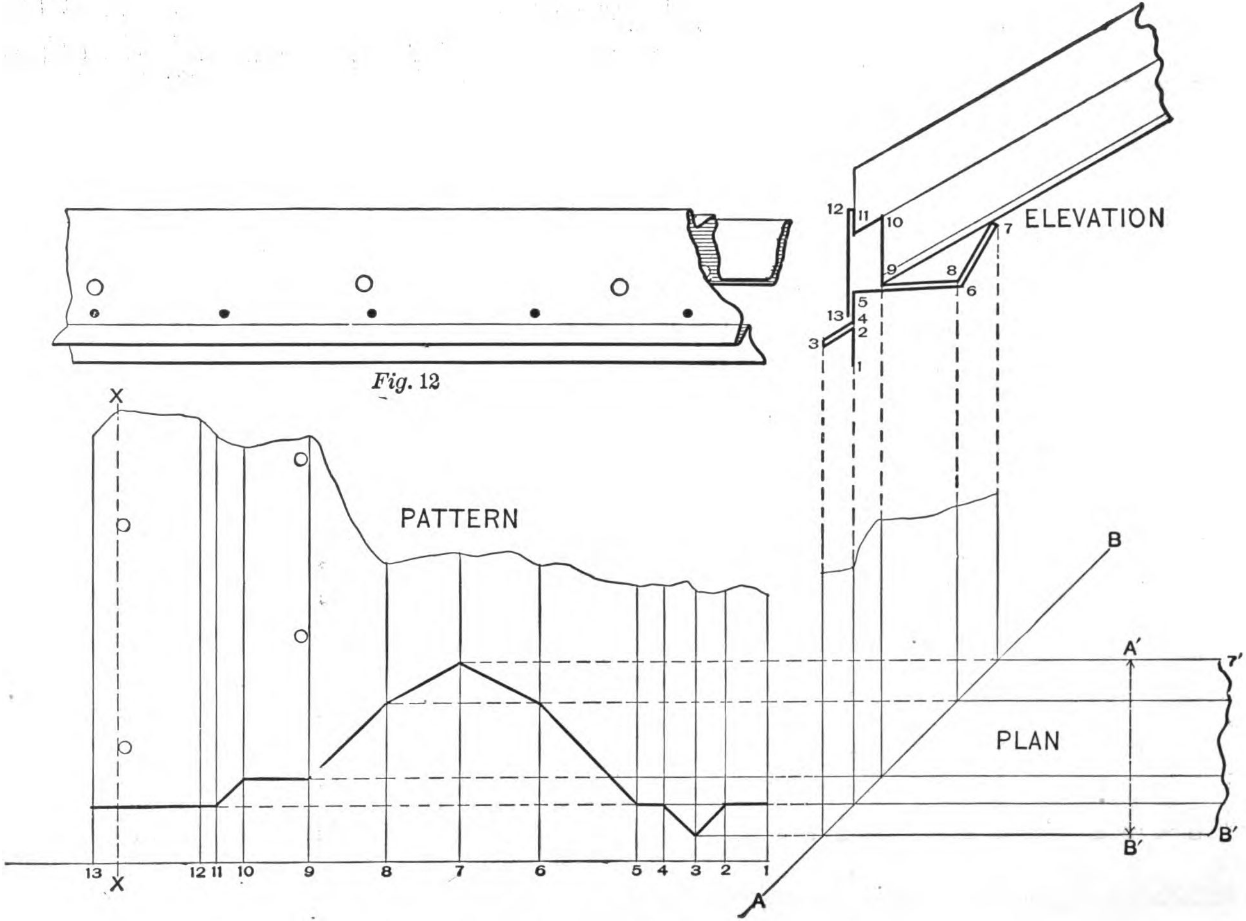


Fig. 12

***Fig.* 11.**

out line drop lines from the various points obtained on miter line A B to their corresponding numbers on stretchout, as indicated by dotted lines. Then a line traced through the points thus obtained in stretchout will be the desired pattern.

As all measures are taken on the glass line (the glass line of curb is point 11), one would necessarily in this case want two sheets twice the length of A D, Fig. 10, with a miter on each end, also two sheets twice the length of D T, Fig. 10, with a miter on each end, measures being taken on line 11 of pattern.

The holes spoken of in Fig. 3 are shown on the pattern and should be punched as shown in pattern. The line X X is merely to show what distance the holes are to be from the edge of the sheet, as will be readily understood by referring to Fig. 3.

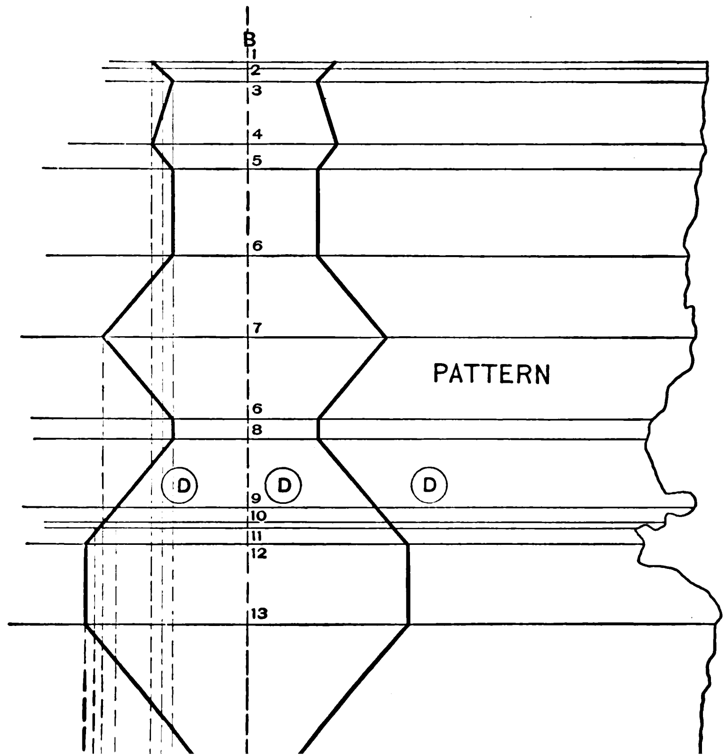
Fig. 12 again shows broken elevation of curb. It will now be necessary to have an elevation to correspond with plan of Fig. 10.

PATTERN FOR COMMON BAR.

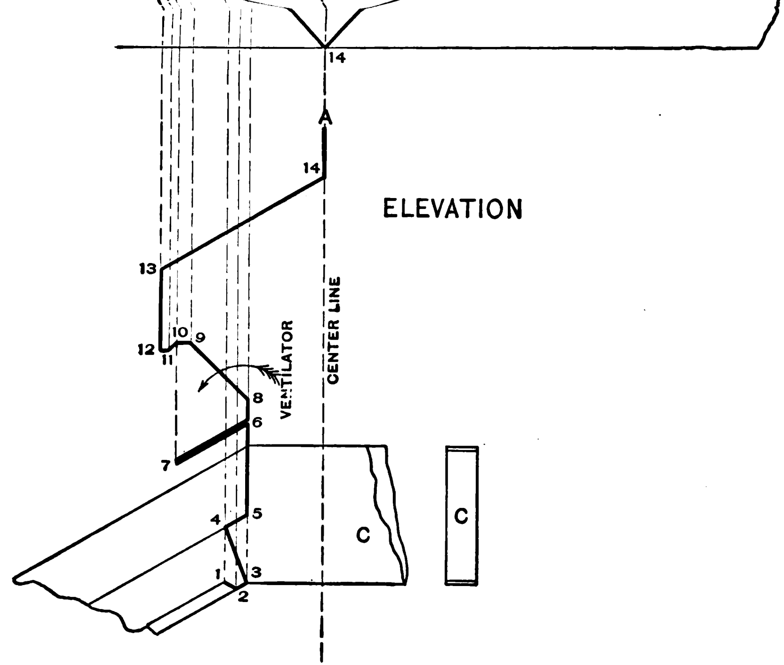
In Fig. 13 draw line A B. At any convenient point, as at C, and at right angles to A B erect perpendicular line D, making space C D equal to space C B of Fig. 10. Also make space C E, Fig. 13, equal to line A B, Fig. 10. Then a line drawn from E to D would be the length of the common bars.

Point 11 of curb being the glass line, and the line D E being the glass line, place the profile of curb at E, as shown. At any convenient point and at right angles to line D E lay off indefinitely line F G. 2 3 of common bar, Fig. 5, being the glass line, place the profile of bar against line D E, as shown. Draw lines parallel to D E through the various points of bar profile until they intersect with curb and cut line C D, as shown. Finish drawing profile of ventilator, as shown, making glass line and condensation trough of ventilator equal to 2 3 and 4 5 of common bar. Lay off stretchout on F G, as shown. Draw lines through the various points of stretchout parallel to line D E. Then drop lines at right angles to D E, from the various points where lines of bar intersect with curb and ventilator to stretchout, as indicated by dotted lines, until they cut corresponding numbers of stretchout. Then a line drawn through the points thus obtained in stretchout will be the necessary pattern for one of the common bars.

Referring to Fig. 1, we find we want eight bars like this.



B
1
2
3
4
5
6
7
PATTERN
6
8
D
D
D
9
10
11
12
13



14
A
14
ELEVATION
13
CENTER LINE
10
9
12
11
VENTILATOR
8
6
7
5
4
C
C
1
3
2

Fig. 14.

PATTERN FOR VENTILATOR.

Having the ventilator now close at hand, we may as well get out the pattern for that before we proceed any further. Taking profile of ventilator produced in Fig. 13, and numbering the various points as indicated in Fig. 14, next draw center line indefinitely, as shown by line A B. On this line lay off stretchout 1 to 14, as shown. Through these points of stretchout and at right angles to A B draw lines indefinitely, as shown.

Then from the numbered points of profile drop lines to corresponding numbers in stretchout, as shown by dotted lines. Then a line drawn through the points thus obtained in stretchout will be the pattern for the end miters of the ventilator, point 5 being glass line. Therefore, a line twice the length of E B, Fig. 10, with a miter cut on each end—that is, measuring on line 5 of pattern—will produce one side of ventilator; or laying off the pattern on the opposite side of center line it will be found that line 5 is just twice the length of E S, Fig. 10, and, therefore, the pattern of one end of the ventilator.

C and C show side and end view of a brace, which is to be put in ventilator between the common bars. D D represents holes for ventilation, and may be as large as the space between 8 and 9 will permit and as close together as may be desired. Fig. 15 shows

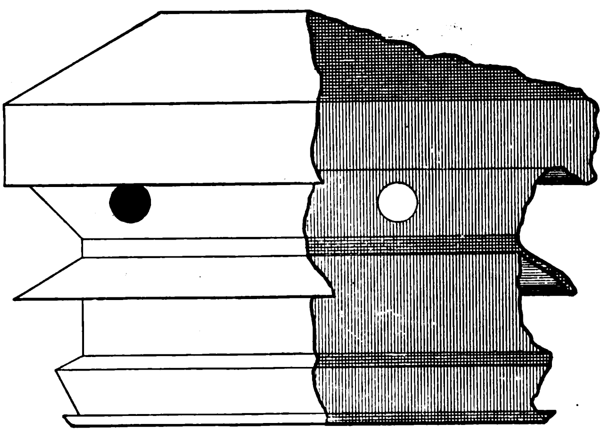


Fig. 15.

broken elevation of ventilator made up. The vent holes should be backed with wire screen to prevent the entrance of insects, etc. This screen should be put on before the ventilator is put together.

It may have been observed before the reader has got thus far that these patterns are applicable to a skylight of any dimensions. The mechanic has therefore to be careful to make quarter plan, Fig. 10, to correspond with the size of skylight wanted, and make the incline of pitch the same in all cases; or, if a different pitch of light is desired, the same general steps are necessary to produce the required patterns as are necessary in this case. The only difference would be that different profiles would be produced in the curb ventilators and hip bars. Therefore, if a light of a different size but of the same pitch as the one here submitted is desired, the mechanic would only have to shift his patterns to correspond to the different lengths of the various bars, the curb and ventilator, as would be produced by a plan of a different size. The miters for the various parts will always be the same as they are in this case for the same pitch. Good judgment will therefore be necessary to make the various bars, etc., of sufficient size to carry the weight, which would necessarily be greater in a light of larger dimensions.

PROFILE OF HIP BAR.

We are now ready to produce the profile of hip bar. Fig. 16 shows the method proposed, it being drawn to correspond in size to plan, Fig. 10. Fig. 17 shows the same method as proposed in Fig. 16, the pitch in both cases being the same. Fig. 17 is drawn in detail, and as the same steps are necessary in both figures to produce the desired results, we will therefore use Fig. 17, as it will be the more readily comprehended.

Again draw elevation as in Fig. 13 (in Fig. 17 it being in detail), using only such portion of ventilator as the bars would come in contact with, as indicated by 1 2 3 4 5 6 of ventilator in Fig. 17. I believe most men who do this kind of work are accustomed to the use of the T-square and the various set squares that are used by draftsmen, such as the 45°, 45°, 90° set square and the 30°, 60°, 90° set squares. I do not deem it necessary to go into a lengthy explanation of their usage, as all know that 90° is a right angle,

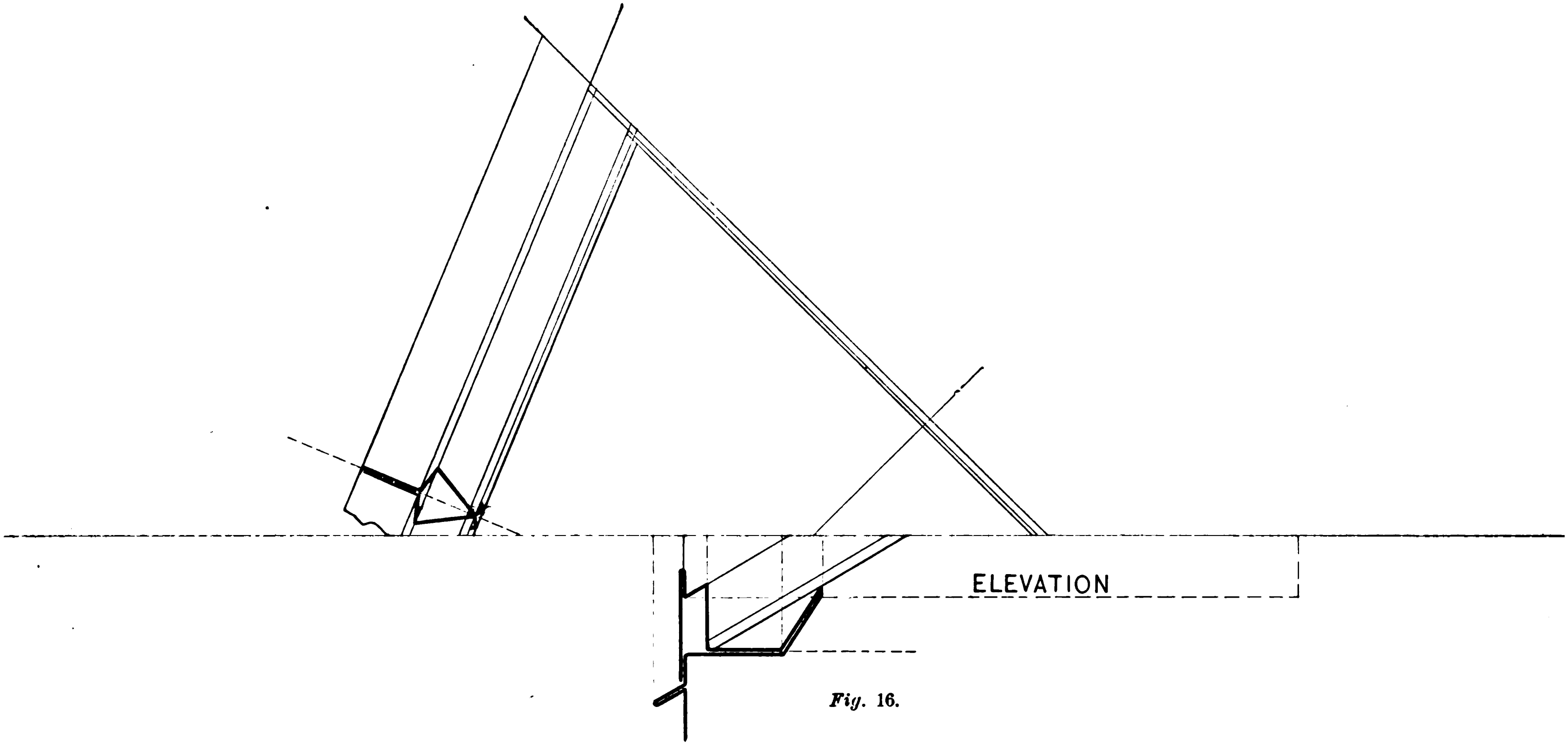


Fig. 16.

and 45° being one-half of 90°, is, therefore, either half pitch or the miter line of a square miter. Therefore, drawing line G H in Fig. 17 at an angle of 45° to A B in elevation of same figure, we have center line of hip bar, as represented by line D E of Fig. 10.

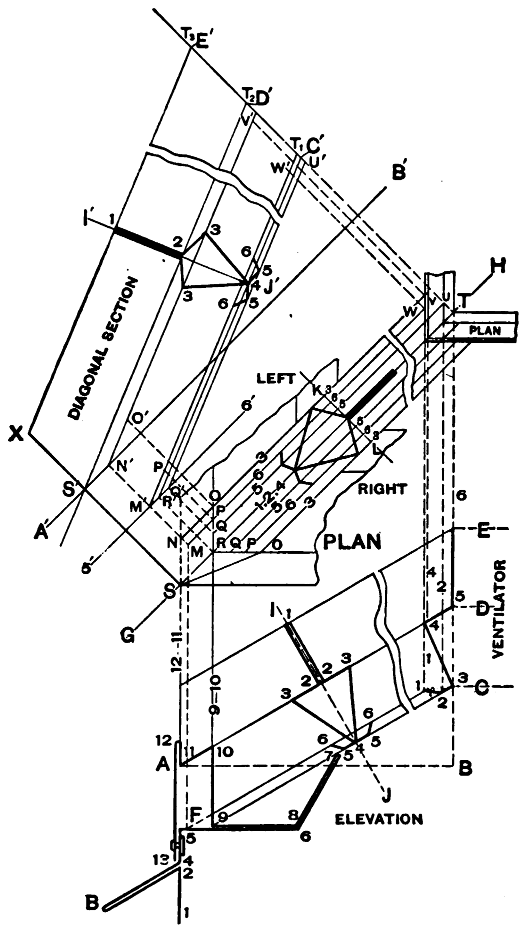


Fig. 17.

At right angles to A B of elevation drop lines to G H in plan, as indicated by dotted lines, using only such portions of curb bar as would be required to find where hip bar would intersect with

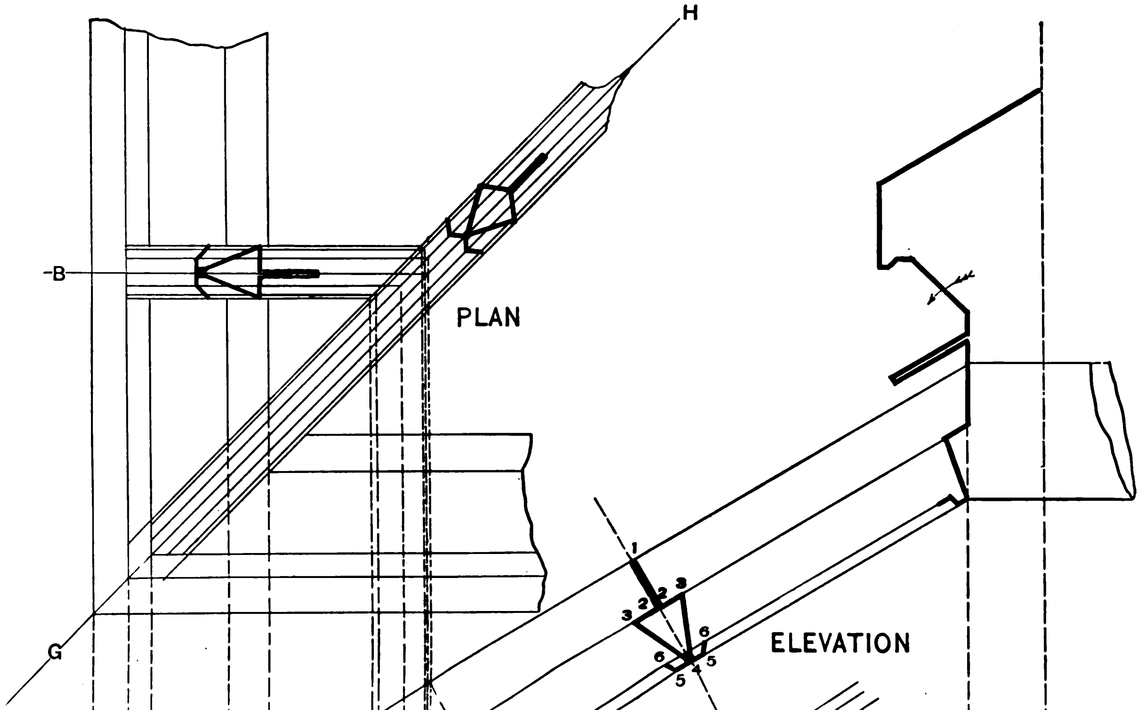
curb in plan. Also drop lines to G H, as indicated from ventilator bar. We therefore have one-half of plan. To produce the other half, lay off at right angles to lines 9, 10, 11, 12 of curb and 1, 2, 3, 4, 5, 6 of ventilator where they intersect with line G H of plan, drawing balance of plan as shown on right side of line G H.

At any convenient point draw line K L, as shown in plan, at right angles to G H. Now we necessarily want the same bearing for the glass to rest on on hip bar as we have on the common bars. Therefore we have G H in plan as center line of hip bar, and I J in elevation as center line of common bars. Transfer the space 2 3, 4 5, 5 6, using line I J as center, to K L of plan, using line G H of plan as center. Through the spaces thus obtained on K L of plan, and parallel to G H, draw lines 5, 6, 3 until they intersect with plan of curb and ventilator, as shown, extending lines 3, 6 of hip bar through line 9 10 of curb bar in plan until they cut line 11 12 of curb bar.

This operation is necessary to establish profile of hip bar, as will be shown later. Next extend line 6, as shown in elevation, through curb by dotted line until it strikes line 5 6 of curb at F. From F drop dotted line at right angles to A B of elevation until it cuts line 6 of plan, establishing point M in plan. We now have points S, M, N, O, P, Q, R in curb plan, of which S O P Q R is the plan of miter in curb and T V U W is plan of miter in ventilator.

It will be necessary, however, to obtain a diagonal section through hip bar before we can obtain profile of hip and the correct miter points for the pattern.

At any convenient point and parallel to line G H of plan draw line A′ B′. At right angles to G H draw from point S the line cutting A′ B′ at S′. Also at right angles to G H of plan draw line, as shown, from point T indefinitely. With space equal to B D of elevation lay off from the line A′ B′ of diagonal section the point D′. Then a line drawn from point S′ to D′ would be the glass line of hip bar. Next draw line 5′ 6′ parallel to A′ B′, as shown in diagonal section, making the space between line A′ B′ and 5′ 6′ equal to space between lines A B and 5 6 of elevation. At right angles to G H of plan from point M draw dotted line cutting line


H
-B
PLAN
G
ELEVATION
1
2
3
4
5
6

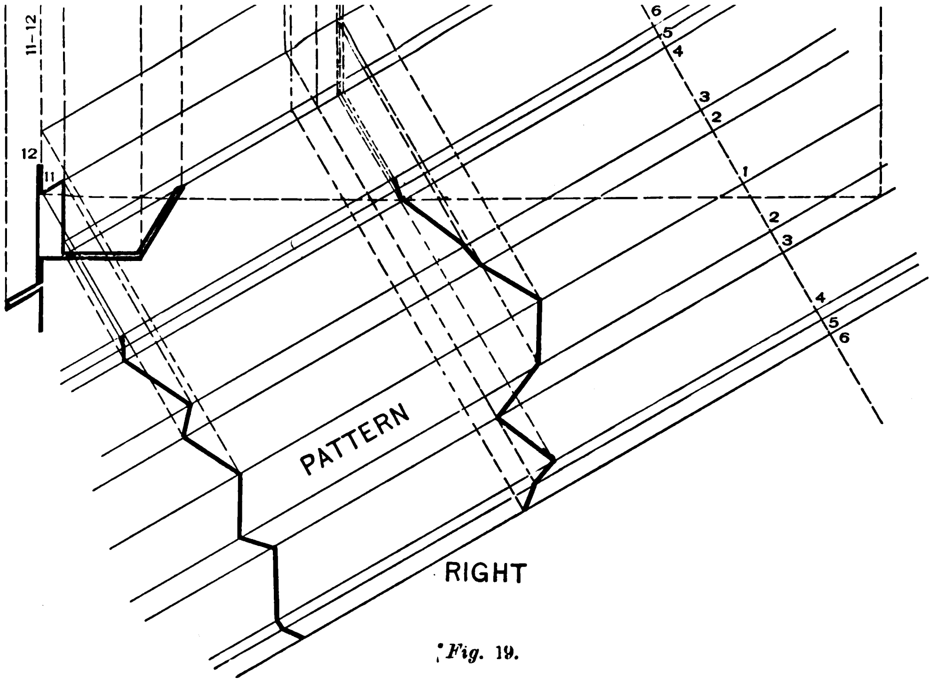


Fig. 19.

5′ 6′ at M′ and cutting line A′ B′ at N′. Also draw dotted lines, as shown, from points R Q, as shown in plan, cutting line 5′ 6′ in diagonal section at R′ Q′. From points thus obtained in diagonal section draw lines parallel to line S′ D′ until they cut the indefinite line drawn from point T in plan. Next lay off point E′ of diagonal section, making it the same distance from D′ as the space between D and E of elevation. From E′ and parallel to S′ D′ draw line cutting line S S′ at X.

We are now ready to lay out profile of hip bar. At any convenient place and at right angles to S′ D′ draw line I′ J′. I′ J′ is therefore the center line of profile of hip bar. With space equal to 2 3 of common bar lay off the spaces 3 3 on the line drawn from the point N′. Then a line drawn from point 2 on center line of hip bar, diagonal section, to points 3 3 would show the profile of that portion of hip bar upon which the glass rests.

From points 3 3 in diagonal section draw lines to center line where it intersects with the line drawn from point R′, establishing the point 4 of hip bar. Again using the line I J of elevation as center, and with space equal to 4 5, establish the points 5 5 in diagonal section hip bar, using the line I′ J′ as center. Lay off points 6 6 of hip bar on line drawn from point M′, making them the same distance from the line I′ J′ as 6 6 are from the line I J of elevation. Connecting points 4, 5, 5 and 5 6, 5 6, as shown, in diagonal section we have the complete profile of the hip bar, which may be transferred to plan, as shown. At right angles to G H of plan drop dotted line from point O until it cuts the line drawn from point N′ of diagonal section, establishing the point O′. Also, drop dotted line from point P of plan until it cuts the line drawn from point M′, diagonal section, establishing point P′.

Drop lines at right angles to G H from points V, W in ventilator plan to lines drawn from points N′, M′, diagonal section, establishing the points V′, W′.

As S, O, R, Q, P in curb plan and T, U, V, W in ventilator plan are the miter points of hip bar as they would appear in plan, and S′, O′, R′, Q′, P′ of curb and T_2, V′, T_1, U′, W′ in ventilator of diagonal section are the miter points of hip bar as they would appear in a diagonal elevation of hip, therefore the miter points of

diagonal section are the correct intersections of hip bar with the curb and ventilator.

PATTERN FOR HIP BAR.

We are now ready to proceed with the laying out of the pattern for the hip bar.

In Fig. 18, extending center line I′ J′ indefinitely, as shown, at right angles to D′ S′, lay off stretchout of hip bar on I′ J′, as shown by 1, 2 2, 3 3, etc. Through these points draw lines parallel to D′ S′ indefinitely, as shown. Then lines dropped from X, S′, O′, R′, Q′, P′ and T_3, T_2, V′, T_2, U′, W′, at right angles to D′ S′, diagonal section, of Fig. 17, and as indicated by dotted lines of Fig. 18, to corresponding numbers of hip bar in the stretchout will, after tracing a line through the points so obtained in stretchout, be the necessary pattern for the hip bar. Referring to Fig. 1, we find we need four hip bars.

PATTERN FOR JACK BARS.

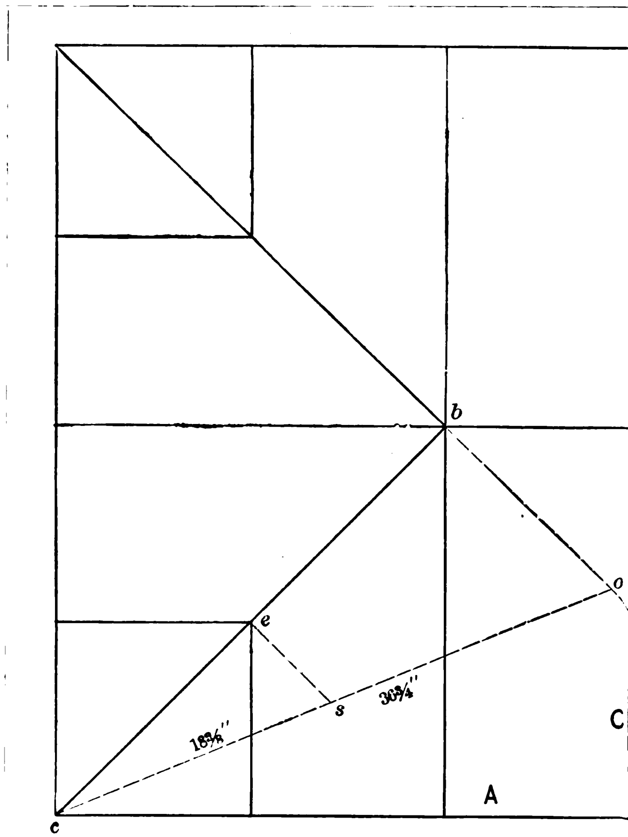
We now have all patterns necessary for the skylight except the pattern for the jack bars. Again taking elevation and plan, as shown in Fig. 19, at right angles to curb line 11 12, lay off the line B until it intersects with the center line of hip bar in plan, the distance from the miter line 11 12 of curb (or one corner of skylight) to line B in this case being the distance that M is from D in Fig. 10. Place the profile of the common bar on line B, as shown.

Parallel to line B drop lines through the various points of profile of common bar until they intersect with corresponding lines of hip bar. From the points thus obtained and at right angles to line B drop lines to corresponding lines of elevation bar—that is, line 1 of plan to intersect with line 1 of elevation, line 2 with line 2, etc., as indicated by dotted lines from plan to elevation. At right angles to elevation lay off stretchout 1, 2 2, 3 3, etc., as shown. Through these points and parallel to elevation bar draw lines indefinitely, as shown. Now from points obtained in elevation bar by lines dropped from plan and at right angles to elevation bar drop lines to corresponding lines in stretchout, as again indicated by dotted lines. Then a line traced through the points obtained in stretchout will be the desired pattern. It will be ob-

served that the miter of the jack bar is the same when it comes in contact with the curb as the miter of the common bars in Fig. 13. As the measuring line of the bars is on line 2, by referring to Fig. 10 (it being a quarter plan) we find we want four jack bars the length of each of the lines G I, J L, M O, and P R, 16 jack bars being required for the skylight in this case.

If it should so happen that a bar should intersect with the ventilator at the same time that the hip bar does, as at E, Fig. 10, one would simply have to use the half of pattern in Fig. 13 for one side of bar and the half of pattern to the right of the center line of pattern in Fig. 19 for the other side of bar.

I would suggest that laps be left on the various miters of the skylight wherever it is deemed desirable, for by so doing the maker may occasionally have an opportunity to put in a rivet and also do a much more secure job of soldering. The bar profiles here submitted are, I think, the simplest kind in use, but it would be necessary to take the same steps as were pursued in this case to produce the patterns for any bar.



Fig

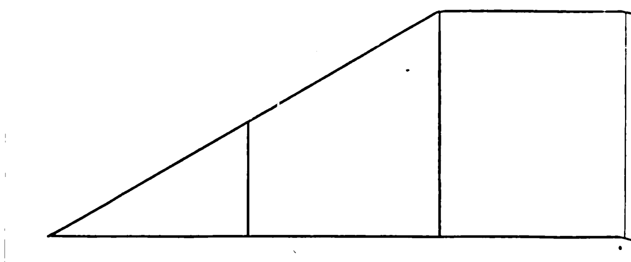
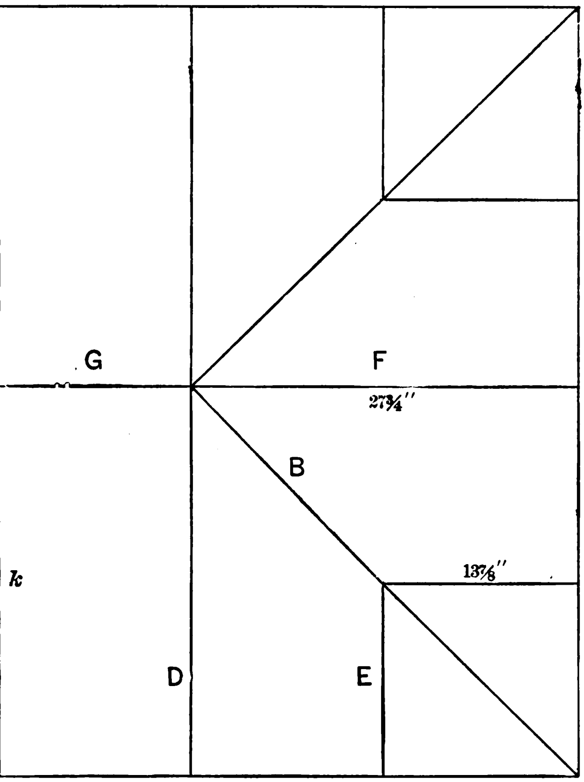
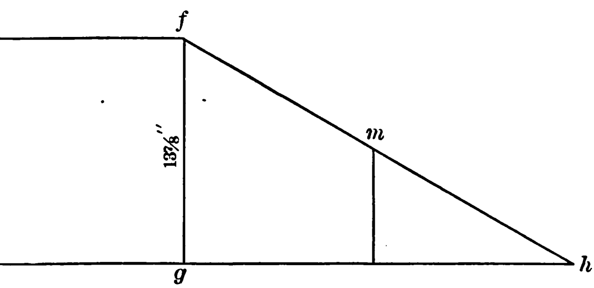


Fig.

Plate I.—Ground Plan and Elevation o



. 1



2

of Skylight (*Scale,* 1 *Inch to the Foot.*)

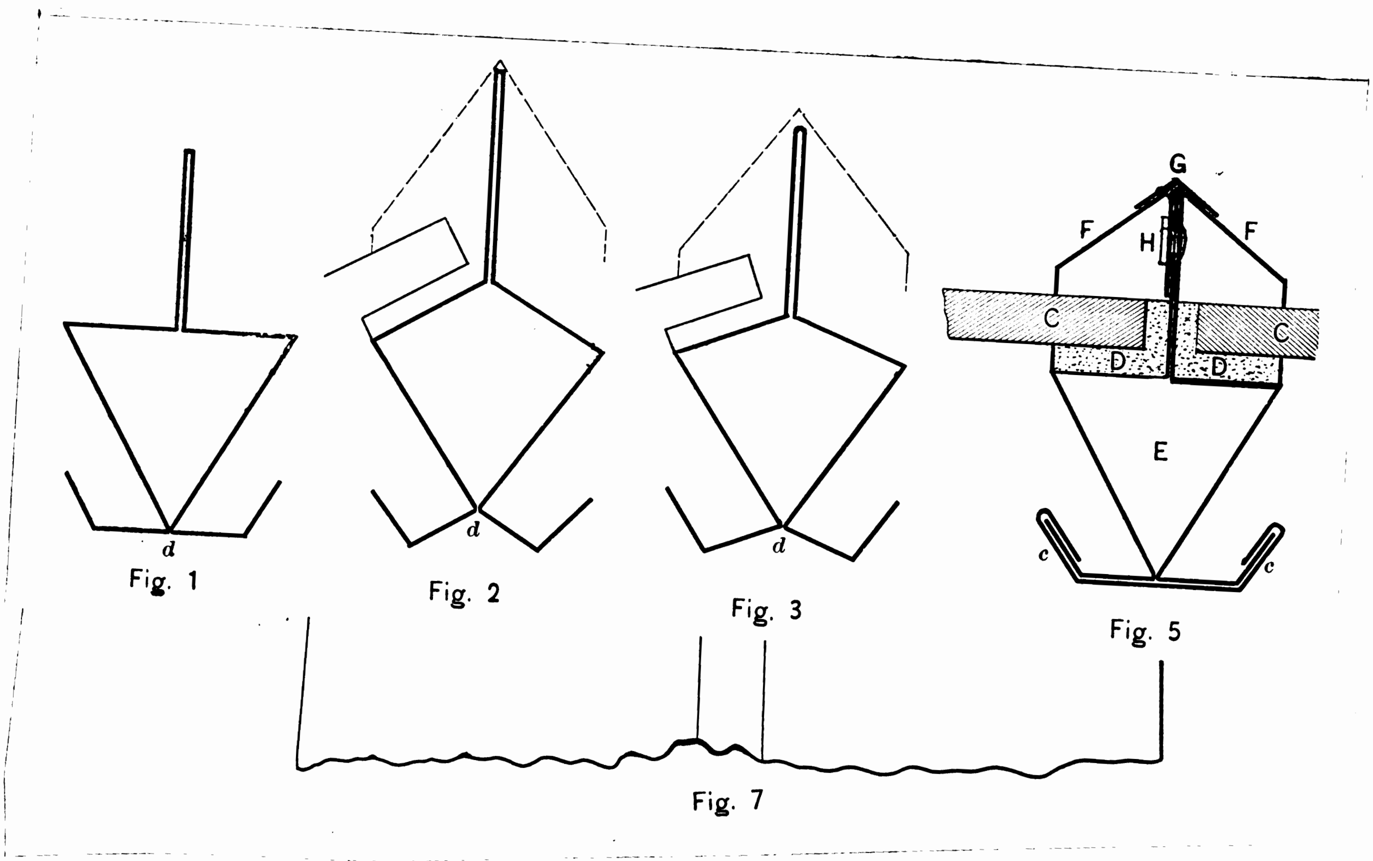


Plate II.—Sectional Views of Base and Curb (Full Size).

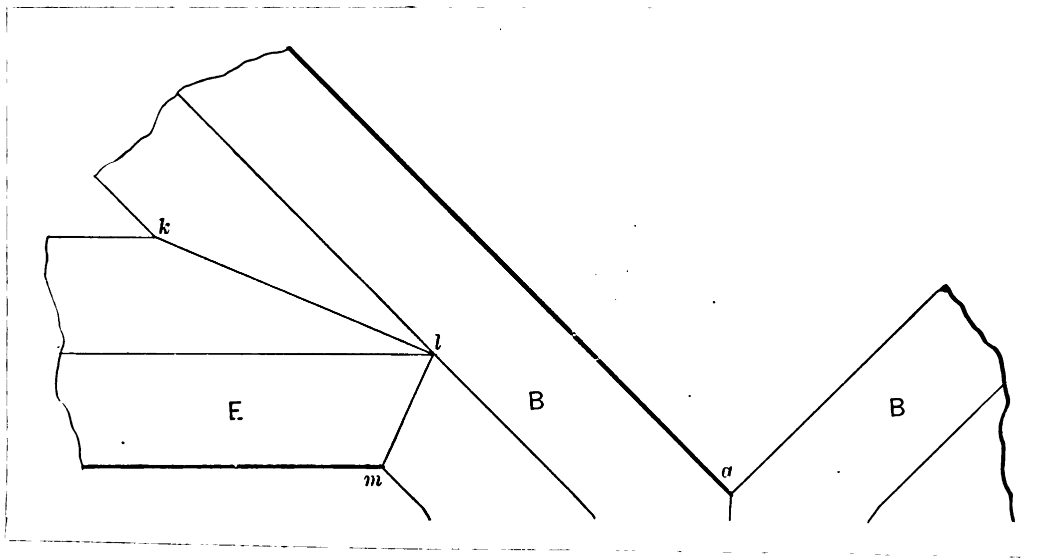


Plate III. Plan of Miters at Top of Bars (Full Size)